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ABSTRACT

This publication provides the evaluation policies, procedures, and standards to which a medium/heavy truck technician training program must adhere to be granted certification by the National Institute for Automotive Service Excellence. The policies section has three parts: the automobile areas that may be certified and minimum requirements for certification; information about evaluation team leaders, on-site evaluation team members, task lists, tools and equipment, and automobile program evaluation; and discussion of policies on articulation agreements, recognition for certification, appeals and action for revocation. The procedures section provides an overview of the process for certification. The next section contains the 10 program standards in these areas: purpose, administration, learning resources, finances, student services, instruction, equipment, facilities, instructional staff, and cooperative agreements. The task list follows. Lists of assumptions and definitions are provided. The tasks are divided into these areas: gasoline engines, diesel engines, drive train, suspension and steering, brakes, electrical/electronic systems, heating and air conditioning, and preventive maintenance inspection. Lists are also provided of applied academics (language arts and communications, mathematics, science) and workplace skills. The final section lists tools and equipment, including hand tools, general lab/shop equipment and specialty tools and equipment. (YLB)

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ED 391 007

ASE PROGRAM CERTIFICATION STANDARDS

Medium/Heavy Truck

Administered By:

National Automotive Technicians Education Foundation (NATEF)
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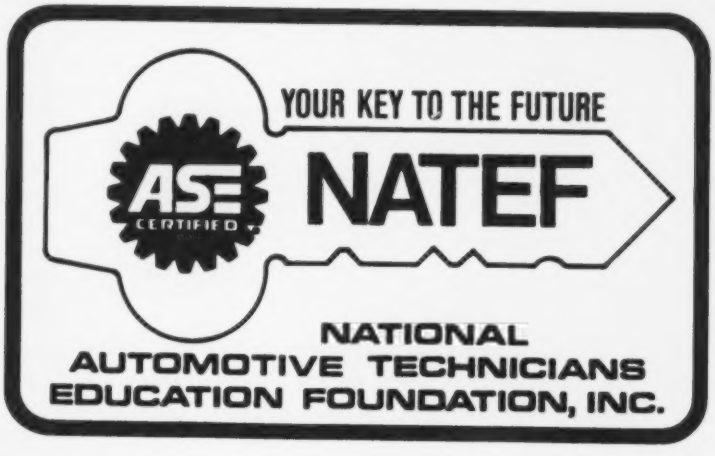

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ASE PROGRAM CERTIFICATION STANDARDS

FOR

MEDIUM/HEAVY TRUCK TECHNICIAN TRAINING PROGRAMS

Administered By:

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POLICIES

MEDIUM/HEAVY TRUCK TECHNICIAN TRAINING CERTIFICATION PROGRAM

The Board of the National Institute for Automotive Service Excellence (ASE) is the responsible body for the Medium/Heavy Truck Technician Training Certification Program. ASE will grant certification to programs that comply with the evaluation procedure, meet established standards, and adhere to the policies in this document.

The Certification Program is under the direct supervision of the Board of Trustees of the National Automotive Technicians Education Foundation (NATEF) and such personnel who are designated or employed by the Foundation.

The purpose of the Medium/Heavy Truck Technician Training Certification Program is to improve the quality of training offered at the secondary and post-secondary levels. NATEF does not endorse specific curricular materials nor provide instruction to individuals, groups or institutions. It does, however, set standards for the content of instruction which includes: tasks, tools and equipment, hours, and instructor qualifications.

The Program is a certification program only and it is <u>not</u> associated with the accreditation role of other agencies.

The cost to each program for certification will be as reasonable as possible to encourage program participation. This cost will include: self-evaluation materials, on-site team evaluation materials, and the honorarium and expenses of the Evaluation Team Leader (ETL).

The eight Truck areas that may be certified are:

1. Diesel Engines
2. Suspension & Steering
3. Brakes
4. Electrical/Electronic Systems
5. Preventive Maintenance Inspection
6. Gasoline Engines
7. Drive Train
8. Heating & Air Conditioning

Effective January 1, 1993, **five** areas are required for minimum certification. The five required areas are: Diesel Engines, Suspension & Steering, Brakes, Electrical/Electronic Systems, and Preventive Maintenance Inspection. Programs wishing to become Master Certified must be certified in Drive Train and Heating and

Air Conditioning in addition to the five required areas. Gasoline Engines is <u>not</u> required for Master Certification status.

MEDIUM/HEAVY TRUCK MINIMUM REQUIREMENTS

1. The minimum program requirements are identical for initial certification and for recertification.

2. A program providing instruction in <u>all</u> of the truck areas must have a minimum total of 1,080 hours (980 hours if Gasoline Engines is <u>not</u> included) of combined laboratory/shop (coop) and classroom instruction. Tasks related to the eight truck areas may be taught at different times during the course of study. Therefore, the hours for an individual area would be the sum total of all the hours of instruction related to the tasks. Individual areas must have the following hours:

a. Diesel Engines	240
b. Suspension & Steering	90
c. Brakes	110
d. Electrical/Electronic Systems	240
e. Preventive Maintenance Inspection	100
f. Gasoline Engines	100
g. Drive Train	100
h. Heating & Air Conditioning	<u>100</u>
TOTAL HOURS	1,080

3. All areas except Gasoline Engines are required for Master Certification designation.

4. **The average rating on Standards 6, 7, 8, and 9 must be a four (4)** on the five-point scale. The program will not be approved for an on-site evaluation if the average is less than 4 on those Standards. The program should make improvements before submitting the application to NATEF for review. **A program will be denied certification if the on-site evaluation team average on Standards 6, 7, 8, and 9 is less than four.**

5. A program may not be approved for an on-site evaluation if the average rating on Standards 1 - 5 and 10 is less than a four (4) on the five-point scale. **A program may be denied certification if the on-site evaluation team average on Standards 1 - 5 and 10 is less than four.** Approval for on-site

evaluation or certification will be made by ASE/NATEF, based on the number of Standards rated at 4 or 5 as well as the individual rating on any Standard rated below 4.

6. The instructor must be ASE Certified in all Medium/Heavy Truck area(s) in which he/she teaches except for any Medium/Heavy Truck area for which there is no ASE test.

7. The program Advisory Committee must conduct at least two working meetings a year and have a minimum of 5 people on the committee. Minutes of the meetings must be provided for review by the on-site evaluation team.

8. The Task List is divided into three priority areas. The following guidelines must be followed:

   95% of all Priority 1 (P-1) items must be taught in the curriculum.
   80% of all Priority 2 (P-2) items must be taught in the curriculum.
   25% of all Priority 3 (P-3) items must be taught in the curriculum.

9. A program that does not meet the minimum hour requirements may be eligible for certification if both of the following conditions are met in the program areas requesting certification:

   a. show evidence that all graduates from the previous academic year have taken the ASE certification examination, and
   b. show documentation that 75% of those graduates passed the ASE certification tests.

10. The concern for safety is paramount to the learning environment. Each program area has the following safety task preceding all related tasks:

    Comply with personal and environmental safety practices associated with clothing, eye protection, hand tools, power equipment, and the handling, storage, and disposal of chemicals and hazardous materials in accordance with local, state, and federal safety and environmental regulations.

INFORMATION ABOUT EVALUATION TEAM LEADERS (ETLs)

Evaluation Team Leaders (ETLs) are educators who have been trained by NATEF to lead the on-site evaluation. The ETL will be assigned by the NATEF office once a program has been approved for an on-site evaluation. Every effort will be made to assign an ETL located closest to the school to reduce the cost for the evaluation. Three additional team members, selected by the program and approved by the ETL, are required for a truck program on-site evaluation. (See the following page for additional information about team members.)

Persons selected as ETLs must have:

1. a minimum of six years of combined experience as an truck technician and truck instructor (at least three years experience as an truck technician is required),
2. a B.A. or B.S. in Education from a college or university recognized for teacher training by the state, and
3. ASE certification in <u>all</u> truck areas.

If a state does not employ truck instructors with the preceding requirements, the following qualifications will apply:

1. six years experience as a truck technician,
2. four years truck teaching experience at the secondary, post-secondary or community college level, and
3. ASE certification in <u>all</u> truck areas.

ETL training is valid for two years. However, automatic two-year renewal is granted every time an ETL conducts an on-site evaluation. ETLs are required to attend additional training sessions if they have not conducted an on-site evaluation in two years. This additional training is required even if the individual holds current ASE certification.

** Anyone interested in becoming an Evaluation Team Leader should contact the NATEF office at (703) 713-0100 or their State Supervisor for more details.

INFORMATION ABOUT ON-SITE EVALUATION TEAM MEMBERS

The program requesting certification is responsible for recruiting and recommending on-site evaluation team members. The ETL must approve individuals recommended by the program. The on-site evaluation team members must be practicing truck technicians, service managers or shop owners from businesses in the area served by the training program. For initial certification only, one team member may be a truck instructor from another school district or system.

Team members must have:

1. high school diploma or the equivalent (industry or military training may be considered as the equivalent), and
2. at least seven years full-time experience as a general truck technician.

* ASE truck certification is recommended but not required.

** A truck instructor from another school district/system must have a minimum total of seven years experience. The seven years must include three or more years full-time experience as a truck technician and three or more years of post high school training.

The **initial** certification evaluation team is composed of four individuals: the ETL and three team members. Two team members must be from industry (one from a dealership and one from an independent repair facility). The third member may be from one of the following: a dealership, an independent repair facility or from a truck training program.

The **recertification** evaluation team is composed of three individuals: the ETL and two team members. One team member must be from a dealership and one team member must be from an independent repair facility.

Each program requesting initial certification or recertification must identify their choices for evaluation team members on the On-Site Evaluation Team Member List. An alternate team member choice must be identified on the On-Site Evaluation Team Member List in the event that one of the team members is unable to conduct the on-site evaluation. **The alternate team member must be from either a dealership or from an independent repair facility.**

Team members must not be advisory committee members, former instructors or graduates of the program within the past ten years.

TASK LIST INFORMATION

An essential element of any curriculum or training program is a valid task list. Truck technician instructors need a well-developed task list that serves as a solid base for course of study outlines and facilitates communication and articulation of their training programs with other institutions in the region.

It is NATEF policy that the task list developed by the National Institute for Automotive Service Excellence (ASE) serves as the basis for the NATEF task list. Panels of technical service experts from the automotive service industry and vocational education are called upon to develop and validate the ASE and NATEF task lists. The ASE task list is also used to develop the ASE certification examination, a nationally recognized symbol of competence in diagnosing and repairing vehicle problems. Additional information on the development of the NATEF task list can be found in the Task List section.

All tasks have a Priority designation.

- **Ninety-five percent (95%) of Priority 1 (P-1) items must be taught in the curriculum.**
- **Eighty percent (80%) of Priority 2 (P-2) items must be taught in the curriculum.**
- **Twenty-five percent (25%) of the Priority 3 (P-3) items must be taught in the curriculum.**

TOOLS AND EQUIPMENT INFORMATION

The basic tools and equipment that must be available for use in the truck program are listed in the Tools and Equipment section. Many tools and much of the equipment are the same for some or all of the program areas. However, some equipment is specialized and must be available for use in the selected program areas. These individual program area lists are included in the Tools and Equipment section.

The student hand tool list covers all program areas. This list indicates the tools a student will need to own to be successful in each of the specialty areas.

Although no brand names are listed, the equipment and tools must address the following programmatic issues:

1. Safety - Equipment and tools must have all shields, guards, and other safety devices in place and operable.
2. Type and Quality - The tools and equipment used in a certified program must be of the type and quality found in industry. They must also be adequate and in sufficient quantity to meet the program goals and student performance objectives.
3. Consumable Supplies - Supplies should be in sufficient quantity to assure continuous instruction. Consumable supplies, such as solvents, sand paper, etc. are not listed.
4. Maintenance - A preventive maintenance schedule should be used to minimize equipment down-time.
5. Replacement - A systematic schedule for replacement should be used to maintain up-to-date tools and equipment at industry and safety standards. Information gained from student program evaluations as well as advisory committee input should be used in the replacement process.
6. Inventory - An inventory system should be used to account for tools, equipment, parts, and supplies.
7. Parts Purchasing - A systematic parts purchasing system should be used - from work order to supplier.
8. Hand Tools - Each student should be encouraged to purchase a hand tool set during the period of instruction.
9. Storage - Adequate storage of tools should be provided. Space for storage of the students' hand tools should be provided.

MEDIUM/HEAVY TRUCK PROGRAM EVALUATION

NATEF Standards for Initial Certification and Recertification are identical. Three items are critical for certification and are in **bold** print in the Medium/Heavy Truck Program Self-Evaluation materials. These three items are:

2.5 A
6.5 A
7.1 A

Programs must be able to support a yes response for 2.5 A and 6.5 A. Programs must hold at least two working meetings of the Advisory Committee each year (2.5 A). In section 6.5 A, the programs must include the required percentage of the P-1, P-2, and P-3 tasks in the areas where certification is desired. Programs must also achieve a 4 on the 5-point scale on item 7.1 A. If these responses are not achieved, do not apply for certification at this time.

In addition, an on-site evaluation will not be scheduled unless the average score on Standards 6, 7, 8, and 9 is at least a 4 on the Truck Program Self-Evaluation. Please refer to the Medium/Heavy Truck Program Requirements for more information.

NATEF POLICIES ON ARTICULATION AGREEMENTS FOR ASE PROGRAM CERTIFICATION

In a number of states and localities technician training programs are able to meet ASE standards for certification only by establishing an articulation effort between secondary and post-secondary programs. Recent NATEF Trustee action, as well as language in the Carl D. Perkins Vocational Education Act, encourages articulation between programs at the secondary and post-secondary levels.

Articulation agreements encourage, but cannot require, graduates of secondary programs to go on to post-secondary education. Financial and social considerations suggest that many, perhaps most, graduates must seek employment upon graduation from high school.

Articulation agreements for Automobile, Autobody, and Medium/Heavy Truck technician training programs may involve two or more training centers at secondary and post-secondary levels or two programs at the secondary level. However, when programs articulate the following conditions must be met:

1. The minimum ASE specialty areas required in Automobile, Autobody, and Medium/Heavy Truck technician training programs must be included.

   Automobile: Brakes, Electrical/Electronic Systems, Engine Performance, and Suspension & Steering.

   Medium/Heavy Truck: Diesel Engines, Suspension & Steering, Brakes, Electrical/Electronic, and Preventive Maintenance Inspection.

   Autobody: Structural Analysis & Damage Repair plus at least two of the following areas:

   Non-Structural Analysis & Damage Repair,
   Mechanical & Electrical Components,
   Plastics & Adhesives,
   Painting & Refinishing

   (Note: A program may be certified in Painting & Refinishing only and would not be required to have an articulation agreement.)

2. Automobile and Medium/Heavy Truck programs must have a minimum of two required specialty areas to articulate with another program for ASE certification purposes.

3. Autobody programs must have Structural Analysis & Damage Repair and one of the four optional program areas to articulate with another program for ASE certification purposes.

**** THE SIGNED, COPY OF THE ARTICULATION AGREEMENT MUST BE SUBMITTED IN EVERY CASE ALONG WITH THE SELF-EVALUATION MATERIALS. ****

4. The articulation agreement must be in writing and approved by the administration of both institutions. The agreement shall:

   a. List the areas of instruction to be offered by each training center.

   b. Stipulate how credit will be granted for successful completion of the instructional areas at each institution. This should also include the criteria for evaluating successful completion.

   c. Describe procedures for applying for credit at the post-secondary level for instruction received at the secondary level.

5. WHEN TWO OR MORE CENTERS ARE TO BE EVALUATED AT THE SAME TIME

   The procedures for submitting the self-evaluation materials and on-site team evaluation application are as follows:

   a. Each training center in an articulation agreement shall conduct a self-evaluation for the specialty areas at their training center. The center requesting the largest number of specialty areas to be certified shall be designated the lead center. If the participating centers are requesting the same number of areas certified, they will select one center as the lead center. The lead center will be responsible for submitting all self-evaluation materials including a cover letter and a signed, copy of the articulation agreement.

   b. When two or more centers under an articulation agreement are being evaluated at the same time they shall agree upon the selection of the on-site evaluation team members.

   c. The NATEF office must be informed of the number of training centers and specialty areas being evaluated. The number of centers and areas being evaluated may require additional members or additional days to complete the evaluation.

d. The division of the local costs involved for the on-site evaluation is to be explained on the Application for On-Site Evaluation.

e. The curriculum for the articulated centers requesting certification shall be sent by the lead center to the Evaluation Team Leader assigned by NATEF.

6. WHEN ONE CENTER IS ALREADY CERTIFIED

The procedures for submitting the self-evaluation materials and on-site team evaluation application are as follows:

a. When a training center is entering into an articulation agreement with a center that is currently certified, the center that is not certified will submit the self-evaluation materials along with a signed, copy of the articulation agreement. The uncertified center will follow through with the total certification process.

b. The on-site evaluation team members will only evaluate the materials at the training center requesting certification.

c. The training center that is already certified will NOT be required to be evaluated until they are due to recertify their training program.

7. Articulated training centers may certify in one or more of the same specialty areas as long as they meet the minimum required areas jointly. For example, one automotive training center (Center A) may be certified in four or more areas, including the minimum required areas. The articulated automotive training center (Center B) may offer only two of the required areas. Center B would be eligible for certification only after articulating with Center A.

8. Each training center in an articulation agreement shall provide their graduates with a certificate identifying successful completion of instructional areas meeting ASE standards.

9. Certification shall be awarded for each articulated program. Each secondary and post-secondary program shall receive a plaque which will include specialty area plates only for instructional areas offered in their training center.

10. The certified plaque shall indicate the name of the training center and will include "articulated with _____ training center". This will clearly indicate that a training center may be certified in fewer than the required areas only when it articulates with another training center.

RECOGNITION FOR CERTIFICATION

A program approved for certification will receive a plaque that bears the ASE seal and the school's name. Individual plates will be attached to the plaque to identify the areas in which the program is certified. These will also include the expiration date of certification. Any program certified in all areas will receive a Master Certification plaque. A statement below the seal will read:

> "THE INSTRUCTION, COURSE OF STUDY, FACILITIES AND EQUIPMENT OF THIS INSTITUTION HAVE BEEN EVALUATED BY THE NATIONAL AUTOMOTIVE TECHNICIANS EDUCATION FOUNDATION AND MEET THE NATIONAL INSTITUTE FOR AUTOMOTIVE SERVICE EXCELLENCE STANDARDS OF QUALITY FOR THE TRAINING OF TRUCK TECHNICIANS IN THE FOLLOWING AREAS:
>
> _____
>
> _____
>
> _____"

Institutions receiving ASE certification are encouraged to put on the graduate's diploma or certificate the following statement:

> "The person holding this diploma has participated in a truck technician training program that was certified by the National Institute for Automotive Service Excellence and has completed instruction in the following areas:
>
> _____
>
> _____
>
> _____"

A screened ASE/NATEF logo may be overprinted with the above statement and placed on the graduate's diploma. A camera ready logo is provided in the promotional material a program receives upon certification.

A program approved for recertification will receive a brass plate which reads "RECERTIFIED Exp. 19__".

Certified programs will also receive a 24"x30" sign indicating that the training program is ASE certified.

APPEALS AND ACTION FOR REVOCATION

APPEALS: PROGRAMS APPLYING FOR CERTIFICATION

A complaint received from any school concerning the procedures, evaluation or certification of the truck technicians training program must be made in writing to the ASE office in Herndon, VA. It will be immediately referred to the Grievance Examiner who will acknowledge receipt of the complaint, in writing, to the complainants. Thereafter, the Grievance Examiner will investigate the complaint and prepare a report. A copy of the report will be given to the complainants and to an Appeals Committee within thirty (30) days of the receipt of the complaint.

The Appeals Committee will review the findings and recommendations of the Grievance Examiner, together with the complaint and any data supplied in connection therewith. The Appeals Committee will be empowered to dismiss the matter or to initiate such action as they may deem appropriate.

If the complainants desire to review the Appeals Committee's evaluation, they may do so at the office of the Grievance Examiner in Herndon, VA. However, they will not be permitted to make copies of the results.

ACTION FOR REVOCATION: ASE CERTIFIED PROGRAMS

The Appeals Committee will also advise the ASE President of its judgements and recommendations for action in any cases of malpractice or misrepresentation involving the misuse of ASE certification for a truck technician training program. Upon receipt of a complaint alleging misuse or misrepresentation by a certified program, the Grievance Examiner will be notified. The Grievance Examiner will notify, in writing, the parties against whom the complaint has been filed, indicating the alleged wrongdoing. The parties will be further advised that they may submit a written explanation concerning the circumstances of the complaint within thirty (30) days. After the Grievance Examiner has considered the complaint and received the explanation, if any, the Grievance Examiner will determine whether there is a reasonable basis for a possible wrongdoing. If the Grievance Examiner finds such a basis, the Grievance Examiner will inform the parties of the findings. At that time, the Grievance Examiner will inform the parties of their right to a hearing before the Appeals Committee. The parties will have fifteen (15) days to notify the Grievance Examiner, in writing, of their decision.

In the event the involved parties elect to be bound by the findings of the Grievance Examiner without a hearing, the Grievance Examiner will submit a written report with recommendations to the Chairman of the Appeals Committee. This report will be submitted

within sixty (60) days of the receipt of the waiver of a hearing. The Chairman of the Appeals Committee will mail a copy of the Grievance Examiner's findings and recommendations to the parties.

In the event that the involved parties elect to appear at a hearing, the Chairman of the Appeals Committee will call a Board of Inquiry. This Board will consist of four ASE Board members, one from each of the following categories: Education, Public Interest, Service Employers, and Vehicle and Service Products Manufacturers. The Board of Inquiry will be convened in Herndon, VA at a date and time determined by the Chairman. The Board will notify the involved parties, in writing, regarding the time and place of the hearing.

The Grievance Examiner will be responsible for investigating and presenting all matters pertinent to the alleged wrongdoing to the Board of Inquiry. The involved parties will be entitled to be at the hearings with or without counsel. The parties will be given an opportunity to present such evidence or testimony as they deem appropriate.

The Board of Inquiry will notify the Chairman of the Appeals Committee of its findings and recommendations, in writing, ten (10) days after the hearing is completed.

The Appeals Committee will review the findings and recommendations of either the Grievance Examiner if a hearing was waived or the Board of Inquiry if a hearing was held. The Appeals Committee will determine if the record on the complaint supports a finding of conduct contrary to or in violation of reasonable practices. If two-thirds of the Appeals Committee so find, the Committee will recommend to the President of ASE appropriate sanctions or courses of action against the parties charged.

PROCEDURES FOR CERTIFICATION/RECERTIFICATION

Process Overview

NOTE: NATEF recommends that programs maintain a file containing copies of all reference and documentation materials developed during all phases of the certification process.

1. Purchase application materials

The program requesting certification must purchase self-evaluation materials from NATEF in Herndon, VA. To begin the certification process, the program must return four items from the evaluation materials packet. These four items are:

a. Application for Certification or Recertification
b. Self-Evaluation Summary Sheet
c. On-site Evaluation Team Member List
d. Instructor Qualifications Forms

2. NATEF review of application

The national office will review the materials within 30 days. Following the review, the program administrator and the state Trade & Industrial Supervisor will be notified about the status of the program. The program will be identified as one of the following:

a. qualified for on-site evaluation for all the specialty areas listed on the application.
b. qualified for on-site evaluation for some but not all specialty areas listed on the application. The program administrator may proceed with the on-site evaluation for the specialty areas that qualify at that time OR make improvements and resubmit the application at a later date.
c. not qualified for an on-site evaluation at that time. NATEF will indicate specific improvements that must be made before the on-site evaluation can be scheduled.

3. Evaluation Team Leader (ETL) assigned, program coordinator makes contacts

In cooperation with state officials, NATEF will assign an Evaluation Team Leader (ETL) to a program. NATEF will also send the program the Application for On-site Evaluation. With a legitimate reason, the program coordinator can contact the NATEF office to request a different ETL. (The ETL assigned must NOT be a present or former teacher or administrator of the program to be evaluated.) The program coordinator must contact the ETL to arrange a date for the on-site evaluation.

The Application for the On-site Evaluation will be sent with instructions that outline the plans for the local administration and the costs for the ETL's services and expenses. These costs will be paid by the institution requesting certification.

4. Send on-site application, check, course of study, and list of on-site evaluation team members to ETL

The Application for On-site Evaluation must be sent to the ETL, signed by the program administrator, and accompanied by a check to cover the costs of materials for the on-site evaluation team members. A copy of the course of study and this application must be received by the ETL at least two weeks prior to the on-site evaluation or the on-site must be rescheduled. The course of study should include the following items:

a. syllabus for each class
b. task list for each area with High Priority (P-1, P-2, P-3) designations listed
c. number of contact hours for each area
d. a schedule of class offerings
e. list of training materials and audio-visual materials used in training
f. sample evaluation form used to track student progress

Include the On-site Evaluation Team Member List for the ETL to review and approve. Once a date has been set and the on-site evaluation team members have been approved by the ETL, the program coordinator must contact the on-site evaluation team members to make arrangements for the evaluation day(s).

5. On-site evaluation

Initial certification requires 2 consecutive days for the on-site evaluation review of all the Standards.

Recertification requires 1-day on-site evaluation and Standards 6-9 are reviewed by the on-site evaluation team. However, if the Advisory Committee average on Standards 1-5 or Standard 10 was less than 4, these Standards must be reviewed by the on-site evaluation team. The NATEF office will determine whether an additional day or additional team members will be required to complete the evaluation.

6. ETL reports results to NATEF

The ETL will submit all on-site evaluation materials and a final report to NATEF with a recommendation for or against program certification.

7. Program certification

The national office will review the final report and all additional evaluation materials to determine whether the program

meets the requirements for certification and will make their recommendation to the ASE Board. The ASE President, however, will approve certification as sanctioned by the Board.

Programs that do not earn certification will be given a written report specifying improvements that must be made to qualify for certification. The decision at the national level will be final unless appealed to the ASE Board of Directors. Appeals will be heard only at regular meetings of the Board.

The program administrator and the state Trade & Industrial Supervisor will be notified of all decisions regarding the certification status of all programs applying for ASE certification.

8. Display and reporting of certification materials

A wall plaque identifying the certified areas will be forwarded from the national office to the program administrator. Schools must accurately report areas of ASE certification.

9. Certified Truck Technician Training List

The NATEF office maintains a current listing of all ASE certified programs. The list is made available upon request.

10. Compliance report

A program will be certified for five years. A compliance report is required after 2½ years. The compliance report will be used to verify that a program is maintaining its standards. NATEF will notify the program administrator of the compliance date and will send the appropriate certification review forms at that time. The program administrator must complete the forms and return them to the NATEF office.

11. Recertification

The NATEF office will contact the program coordinator six (6) months prior to the certification expiration date. The program must formally request recertification materials and follow the process outlined above.

On-site Evaluation Cost Sheet

TRUCK

	CERTIFICATION	**RECERTIFICATION**
Certification Manuals (Applied Academics general statements and workplace skills list are included)	$60.00	$50.00
On-site Evaluation Team Manuals (minimum of 4 sets for initial cert. and 3 sets for recert. @ $40 each.)	160.00	120.00
Honorarium for Evaluation Team Leader (ETL) @ $175/day	350.00	175.00
Estimated mileage, hotel and meal expenses for the ETL	150.00	100.00
ESTIMATED TOTAL COSTS	$720.00	$445.00

NOTE: It is anticipated that team members recruited from local independent repair facilities and dealerships will serve without charge to the institution.

MEDIUM/HEAVY TRUCK PROGRAM STANDARDS

STANDARD 1 - PURPOSE

THE TRUCK TECHNICIAN TRAINING PROGRAM SHOULD HAVE CLEARLY STATED PROGRAM GOALS, RELATED TO THE NEEDS OF THE STUDENTS AND EMPLOYERS SERVED.

Standard 1.1 - Employment Potential

The employment potential for truck technicians, trained to the level for the specialty or general areas outlined in the program goals, should exist in the geographic area served by the program.

Standard 1.2 - Program Description/Goals

The written description/goals of the program should be shared with potential students and should include admission requirements, employment potential, area(s) of specialty training offered, and the cost of all tuition and fees. Technical qualifications of the faculty and the overall goal(s) of the program should also be included.

STANDARD 2 - ADMINISTRATION

PROGRAM ADMINISTRATION SHOULD ENSURE THAT INSTRUCTIONAL ACTIVITIES SUPPORT AND PROMOTE THE GOALS OF THE PROGRAM.

Standard 2.1 - Student Competency Certification

The certificate or diploma a student receives upon program completion should clearly specify the area(s) of demonstrated competency.

Standard 2.2 - Chain of Command

An organizational chart should be used to indicate the responsibilities for instruction, administration, and support services.

Standard 2.3 - Administrative Support

Positive administrative support from institutional and local governing bodies should be demonstrated. Indicators of administrative support would include: support for staff in-service training; provision of appropriate facilities; up-to-date tools, equipment, and training support materials.

Standard 2.4 - Written Policies

Written policies should be adopted by the administration and policy board for use in decision-making situations and to provide guidance in achieving the program goals. Policies regarding

safety, liability, and lab/shop operation should be written and prominently displayed as well as provided to all students and instructors.

Standard 2.5 - Advisory Committee

An Advisory Committee must convene at least two times a year and be utilized to provide counsel, assistance, and information from the community served by the training program. This Committee should be broadly based and include former students, employed technicians, employers, and representatives for consumer's interests.

Standard 2.6 - Public/Community Relations

An organized plan should be used to provide the community at large information regarding the training program, its graduates, its plans, and any services provided to the community.

Standard 2.7 - Live Work

A systematic method of collecting, documenting, and disbursing live work repair receipts should be used. Instructional staff should not be required to collect payment for live work repairs.

STANDARD 3 - LEARNING RESOURCES

SUPPORT MATERIAL, CONSISTENT WITH BOTH PROGRAM GOALS AND PERFORMANCE OBJECTIVES, SHOULD BE AVAILABLE TO STAFF AND STUDENTS.

Standard 3.1 - Service Information

Service information with current manufacturers' service procedures and specification data for vehicles manufactured within the last ten (10) years should be available. This information should be accessible to students while working in the lab/shop area.

Standard 3.2 - Multimedia

Appropriate up-to-date multimedia materials such as video equipment, transparencies, etc. should be readily available and utilized in the training process.

Standard 3.3 - Instructional Development Services

The service of professional instructional development personnel should be used when available. At a minimum, equipment and supplies should be available for duplication or copying printed materials and transparencies. Instructional development personnel should conduct in-service and/or training in curriculum and media development.

Standard 3.4 - Periodicals

Current general and technical truck magazines and newspapers should be available for student and instructor use.

Standard 3.5 - Student Materials

Necessary instructional texts or pertinent material should be available for each student to satisfy the objectives of the mode of instruction used. Basic textbooks should have copyright dates that are not over six (6) years old; specialized textbooks should have copyright dates that are not over six (6) years old.

STANDARD 4 - FINANCES

FUNDING SHOULD BE PROVIDED TO MEET THE PROGRAM GOALS AND PERFORMANCE OBJECTIVES.

Standard 4.1 - Program Training Cost

The enrollment in the program or program area should be sufficient to keep the per-student training costs to a realistic figure.

Standard 4.2 - Budget

An adequate annual budget should be developed, allocated, and used for the operation of the program.

Standard 4.3 - Budget Preparation

The budget should be prepared by the institutional administration in conjunction with the program faculty.

Standard 4.4 - Status Reports

Budget status reports should be made available to program staff, at least quarterly.

STANDARD 5 - STUDENT SERVICES

SYSTEMATIC PRE-ADMISSION TESTING, INTERVIEWS, COUNSELING SERVICES, PLACEMENT, AND FOLLOW-UP PROCEDURES SHOULD BE USED.

Standard 5.1 - Pretesting

A formal pretesting program should be used to assess a student's abilities in reading, mathematics, and mechanical aptitude to evaluate and assure the student a reasonable probability of success as a truck technician. Testing procedures should be stated in program explanatory material and justification for all requirements should be available.

Standard 5.2 - Pre-admission Interviews

Prior to program admission, a student should be interviewed and approved for admission.

Standard 5.3 - Student Records

Permanent records of former students should be available, preferably in one central location, and kept confidential.

Standard 5.4 - Placement

A systematic student placement system should be used to assist program graduates to obtain employment in the truck industry.

Standard 5.5 - Follow-up

A follow-up system should be used to determine students' employment location and for feedback regarding the efficiency, effectiveness, and appropriateness of training. The follow-up procedure should be designed to assure feedback regarding needed additions or deletions to the training curriculum, program, and tools and equipment. Follow-up of graduates employed outside of the truck industry should indicate reasons for non-truck employment. When applicable, this information should be used to modify the training quality and/or content.

Standard 5.6 - Legal Requirements

The training program should meet all applicable local, state, and federal requirements.

STANDARD 6 - INSTRUCTION

INSTRUCTION MUST BE SYSTEMATIC AND REFLECT PROGRAM GOALS. A TASK LIST AND SPECIFIC PERFORMANCE OBJECTIVES WITH CRITERION REFERENCED MEASURES MUST BE USED.

Standard 6.1 - Program Plan

The training plan should progress in logical steps, provide for alternate sequences, where applicable, and be made available to each student.

Standard 6.2 - Student Training Plan

A training plan for each student should be used, indicating the student's training goal(s) and specific steps needed to meet that goal. Students should be given a copy of their training plan.

Standard 6.3 - Preparation Time

Adequate time should be provided for teacher preparation and program development.

Standard 6.4 - Teaching Load

The instructor/student ratio and class contact hours should allow time for interaction on a one-to-one basis.

Standard 6.5 - Curriculum

All tasks have been given a priority rating. Ninety-five percent (95%) of the tasks designated as Priority 1 (P-1) must be taught in the curriculum. Eighty percent (80%) of the tasks designated as Priority 2 (P-2) must be taught in the curriculum. Twenty-five percent (25%) of the tasks designated as Priority 3

(P-3) must be taught in the curriculum. Additional tasks may be included to meet the needs of local employers. All additional tasks should be approved by the Advisory Committee.

Instruction on the legal aspects and responsibilities of the truck technician in areas such as Environmental Protection Agency regulations, safety regulations, OSHA regulations, and other appropriate requirements should be included in the curriculum. Instruction and practice in filling out work order forms, ordering parts, and basic record keeping should be a part of the training program.

Tools and equipment must be available to perform the tasks in each of the areas for which certification is requested.

Standard 6.6 - Student Progress

A record of each student's progress should be maintained through the use of a progress chart or other recording device. The record should indicate tasks required for mastery in the area and those tasks the student has mastered.

Standard 6.7 - Performance Standards

All instruction should be performance based, with an acceptable performance standard stated for each task. These standards should be shared with students and potential employers. Students should demonstrate "hands-on competency" or "mastery" of a task before the instructor verifies a student's performance.

Standard 6.8 - Safety Standards

Safety instruction should be given prior to lab/shop work and be an integral part of the training program. A safety test should be included in the training program. Students and instructors should comply with personal and environmental safety practices associated with clothing, eye protection, hand tools, power equipment, and the handling, storage, and disposal of chemicals and hazardous materials while in the lab/shop area.

Standard 6.9 - Personal Characteristics

All training activities and instructional material should emphasize the importance of maintaining high personal standards.

Standard 6.10 - Work Habits/Ethics

The training program should be organized in such a manner that work habits and ethical practices required on the job are an integral part of the instruction.

Standard 6.11 - Provision for Individual Differences

The training program should be structured in such a manner that students with different levels of cognitive and psychomotor skills can be accommodated.

Standard 6.12 - Related Instruction

Instruction in related mathematics, communication, and interpersonal relations should be provided and coordinated with ongoing instruction in the training program. This instruction should be provided by a qualified instructor.

Standard 6.13 - Testing

Both written and performance based tests should be used to validate student competency. Students should be encouraged to take certification tests that are publicly recognized indicators of capabilities.

Standard 6.14 - Evaluation of Instruction

Instructional procedures should be evaluated in a systematic manner. This evaluation should be through regular reviews by students and the administration. Self-evaluation of instruction should also be utilized on a systematic and regular basis. This system should include input from former students and the Advisory Committee members. Instructional procedures should show a responsiveness to the feedback from these evaluations.

Standard 6.15 - Live Work

Live work should be scheduled to benefit the student and supplement ongoing instruction on items specified in the NATEF task list. A student should have had instruction and practice on a specific repair task before live work requiring that task is assigned. Donated vehicles by the manufacturers or other sources, customer-owned vehicles, and other training vehicles may be used as the primary source of live work. Truck training program student-owned vehicles, school buses, and other vehicles owned and operated by the governing body of the school should not be the primary source of live work vehicles. All vehicles in the lab/shop should have a completed industry-type work order attached to or on the vehicle.

Standard 6.16 - Articulation

Agreements between programs with equivalent competencies should be used to eliminate unnecessary duplication of instruction.

STANDARD 7 - EQUIPMENT

EQUIPMENT AND TOOLS USED IN THE TRUCK TECHNICIAN TRAINING PROGRAM MUST BE OF THE TYPE AND QUALITY FOUND IN THE REPAIR INDUSTRY AND MUST ALSO BE THE TYPE NEEDED TO PROVIDE TRAINING TO MEET THE PROGRAM GOALS AND PERFORMANCE OBJECTIVES.

Standard 7.1 - Safety

Equipment and tools used in the training program must have all shields, guards, and other safety devices in place, operable, and used.

Standard 7.2 - Quantity and Quality

The tools and equipment used in the training program should reflect the program goals and performance objectives. Sufficient tools and equipment should be available for the training offered. The tools and equipment should meet industry quality standards.

Standard 7.3 - Consumable Supplies

Sufficient consumable supplies should be readily available to assure continuous instruction.

Standard 7.4 - Maintenance

A preventive maintenance schedule should be used to minimize equipment down-time.

Standard 7.5 - Replacement

A systematic schedule for replacement should be used to maintain up-to-date tools and equipment at industry and safety standards. Student follow-up and Advisory Committee input should be used in this system.

Standard 7.6 - Inventory

An inventory system should be used to account for tools, equipment, parts, and supplies.

Standard 7.7 - Parts Purchasing

A systematic parts purchasing system, from work order to parts specialist to jobber, should be used. Task performance should not be unreasonably delayed due to lack of replacement parts.

Standard 7.8 - Hand Tools

Each student should have a basic hand tool set comparable to tools required for employment. The students should be encouraged to purchase a hand tool set during the period of instruction, appropriate to the truck specialty area(s) in which they are receiving training.

STANDARD 8 - FACILITIES

THE PHYSICAL FACILITIES MUST BE ADEQUATE TO PERMIT ACHIEVEMENT OF THE PROGRAM GOALS AND PERFORMANCE OBJECTIVES.

Standard 8.1 - Training Stations

Training stations (bench and live work) should be available in the type and number required for the performance of tasks outlined in the program goals and performance objectives.

Standard 8.2 - Safety

The facilities should meet all applicable safety standards.

Standard 8.3 - Maintenance
A regular facilities maintenance program should be used to ensure facilities are suitable when required for instruction.

Standard 8.4 - Housekeeping
The classroom(s), lab/shop, and support area(s) should be kept clean and orderly.

Standard 8.5 - Office Space
An area separate from the lab/shop should be available and convenient for the instructor(s) use as an office.

Standard 8.6 - Instructional Area
A classroom convenient to, but separate from, the lab/shop area should be available for instruction and other non-lab/shop activities.

Standard 8.7 - Storage
Storage areas for tools, parts, supplies, and trucks should be sufficient to support the activities outlined in the program goals and performance objectives. Security should be provided to prevent pilferage and vandalism.

Standard 8.8 - Support Facilities
Restrooms, clean-up areas, and lockers should be provided for both male and female students and be convenient to the instructional area.

Standard 8.9 - Ventilation
An adequate exhaust fume removal system should be in place and operational. When appropriate, heating and cooling systems should be used to provide sufficient comfort for learning.

Standard 8.10 - First Aid
A first aid kit should be in place and comply with local regulations.

Standard 8.11 - Facility Evaluation
The Advisory Committee should conduct an annual evaluation of the facilities to assure adequacy to meet program goals.

STANDARD 9 - INSTRUCTIONAL STAFF

THE INSTITUTIONAL STAFF MUST HAVE TECHNICAL COMPETENCY AND MEET ALL STATE AND LOCAL REQUIREMENTS FOR CERTIFICATION.

Standard 9.1 - Technical Competency
The instructor must hold current ASE certification in the specialty areas considered for certification.

Standard 9.2 - Instructional Competency/Certification
Instructors should meet all state certifying requirements.

Standard 9.3 - Technical Updating
Faculty members should be provided technical materials required to maintain their competency. An opportunity should be provided for instructors to return to industry on a regular basis for in-service and skill upgrading.

Standard 9.4 - First Aid
The program should have a written policy, approved by the administrator of the school, on First Aid procedures.

Standard 9.5 - Substitutes
A systematic method of obtaining "substitute" instructors should be used to assure instructional continuity. An orientation session for substitutes should be held on a regular basis. The substitute should be a competent truck instructor.

STANDARD 10 - COOPERATIVE AGREEMENTS

WRITTEN POLICIES AND PROCEDURES SHOULD BE USED FOR COOPERATIVE AND APPRENTICESHIP TRAINING PROGRAMS.

Standard 10.1 - Standards
Student performance standards should be developed and coordinated by the supervising instructor.

Standard 10.2 - Agreements
All agreements should be written and legally binding.

Standard 10.3 - Supervision
A supervising truck instructor should be assigned responsibility, authority, and time to coordinate and monitor cooperative/apprenticeship truck programs.

TASK LIST

The NATEF task list was reviewed and updated in 1993 with funding from a grant awarded by the U.S. Department of Education. In December 1993, a national committee was assembled in Herndon, Virginia to review the standards used in the Medium/Heavy Truck certification program. The committee consisted of individuals representing the major truck manufacturers, truck repair shop owners and technicians, truck instructors, truck equipment and parts suppliers, and state Trade and Industrial education supervisors.

The committee reviewed the standards, task list, tools and equipment list, program hours, and instructor qualifications. The committee also had the most current National Institute for Automotive Service Excellence (ASE) truck task lists for reference purposes.

All the tasks are assigned a priority number: P-1, P-2 or P-3. Please refer to the Task List Information in the Policies section for additional information on the requirements for instruction on tasks.

Theory instruction and hands-on performance of all the basic tasks will provide initial training for employment in the Medium/Heavy Truck service field or further training in any or all of the specialty areas. Competency in these tasks will indicate to employers that the graduate is skilled in that area.

ASSUMPTIONS

1. It is assumed:

   * that in all areas, appropriate theory, safety and support instruction will be required in the performance of each task;
   * that this instruction includes identification and use of the appropriate tools and testing and measurement equipment as required.
   * that the student has received the necessary training to locate and use current reference and training materials from accepted industry publications.

2. It is assumed:

   * that all diagnostic and repair tasks described in this document are to be accomplished in accordance with manufacturers' recommended procedures as published.

3. It is assumed:

   * that individual training programs being evaluated for certification should have written and detailed performance standards for each task covered and taught in the curriculum;
   * that learning progress of students will be monitored and evaluated against these performance standards;
   * that a system is in place which informs all students of their individual progress through all phases of the training program.

4. It is assumed:

   * that individual courses of study will differ across medium/heavy truck technician training programs;
   * that development of appropriated learning delivery systems and tests which monitor student progress will be the responsibility of the individual training program.

5. It is assumed:

   * that all students will receive instruction in the storage, handling, and use of Hazardous Materials in accordance with Hazard Communication "Title 29 Code of Federal Regulation Part 1910.1200", "Right to Know Law" and state and local requirements.

6. It is assumed:

   * that any tool requiring calibration will be calibrated according to the manufacturer's specifications periodically or as needed.

7. It is assumed:

   * that students are given instruction in communication techniques with customer.

8. It is assumed:

   * that all students will be instructed in and practice recommended precautions when handling electro-static sensitive devices.

DEFINITIONS

ADD - To increase fluid or pressure to the correct level or amount.

ADJUST - To bring components to specified operational settings.

AIR TEST - To use air pressure to determine proper action of components.

ALIGN - To bring to precise alignment or relative position of components.

ANALYZE - To examine the relationship of components of an operation.

ASSEMBLE (REASSEMBLE) - To fit together the components of a device.

BALANCE - To establish correct linear, rotational or weight relationship.

BLEED - To allow air fluids to enter or exit a closed system.

CHARGE - To bring to "full" state; e.g., battery or air conditioning system.

CHECK - To verify condition by performing an operational or comparative examination.

CLEAN - To rid component of extraneous matter for the purpose of reconditioning, repairing, measuring or reassembling.

DETERMINE - To establish the procedure to be used to effect the necessary repair.

DIAGNOSE - To locate the cause or nature of a problem by using the specified procedure.

DISASSEMBLE - To separate a component's parts as a preparation for cleaning, inspection or service.

DISCHARGE - To empty a storage device or system.

DRAIN - To use gravity to empty a container.

EVACUATE - To remove air, fluid or vapor from a closed system by use of a vacuum pump.

FILL (REFILL) - To bring fluid level to specified point or volume.

FIND - To locate a particular problem, e.g., shorts, grounds or opens in an electrical circuit.

FLUSH - To use a fluid to clean an internal system.

HONE - To restore or resize or bore by using rotating cutting stones.

IDENTIFY - To establish the identity of a vehicle or component prior to service; to determine the nature or degree of a problem.

INSPECT - (SEE CHECK)

INSTALL (REINSTALL) - To place a component in its proper position in a system.

JUMP START - To use an auxiliary power supply, i.e., battery, battery charger, etc. to assist a vehicle's battery to crank an engine.

LEAK TEST - To locate the source of leaks in a component or system.

LISTEN - To use audible clues in the diagnostic process; to hear the customer's description of a particular problem.

LUBRICATE - To employ the correct procedures and materials in performing the prescribed lubrication service.

MEASURE - To compare existing dimensions to specified dimensions by the use of calibrated instruments and gauges.

MOUNT - To attach or place tool or component in proper position.

PRESSURE TEST - To use air or fluid pressure to determine the condition or operation of a component or system.

PERFORM - To accomplish a procedure in accordance with established methods.

PURGE - To eliminate a undesired air or fluid from a closed system.

READY - To prepare a system or component for service, installation or operation.

REASSEMBLE - (SEE ASSEMBLE)

REFILL - (SEE FILL)

REINSTALL - (SEE INSTALL)

REMOVE - To disconnect and separate a component from a system.

REPAIR - To restore a malfunctioning component or system to operating condition.

REPLACE - To exchange an unserviceable component with a new or rebuilt component; to reinstall a component.

RESET (SET) - To adjust a variable component to a given, usually initial, specification.

SELECT - To choose the correct part or setting during assembly or adjustment.

SERVICE - To accomplish a procedure such as changing of fluids, filters, or lube chassis and components as recommended in owner's and service manual.

TEST - To verify condition through the use of meters, gauges or instruments.

TRIM - (SEE ADJUST)

TORQUE - To tighten a fastener to specified degree or tightness (in a given order or pattern if multiple fasteners are involved on a single component).

VACUUM TEST - To determine the integrity and operation of a vacuum operated component and/or system.

VERIFY - To establish that a problem exists after hearing the customer's complaint and performing a preliminary diagnosis.

Task List Priority Item Totals (by area)

I. Gasoline Engines

P-1 = 20
P-2 = 45
P-3 = 32

II. Diesel Engines

P-1 = 19
P-2 = 43
P-3 = 44

III. Drive Train

P-1 = 3
P-2 = 31
P-3 = 30

IV. Suspension & Steering

P-1 = 16
P-2 = 26
P-3 = 21

V. Brakes

P-1 = 7
P-2 = 51
P-3 = 7

VI. Electrical/Electronic Systems

P-1 = 13
P-2 = 33
P-3 = 13

VII. Heating & Air Conditioning

P-1 = 10
P-2 = 23
P-3 = 19

VIII. Preventive Maintenance Inspection

P-1 = 45
P-2 = 0
P-3 = 0

NATEF TASK LIST

GASOLINE ENGINES

For every task in Gasoline Engines the following safety task must be strictly enforced as a number 1 priority:

Comply with personal and environmental safety practices associated with clothing, eye protection, hand tools, power equipment and the handling, storage and disposal of chemicals and hazardous materials in accordance with local, state, and federal safety and environmental regulations.

I. GASOLINE ENGINES

A. General Engine Diagnosis; Removal and Reinstallation (R & R)

1.	Verify and interpret complaint; determine needed repairs.	P-2
2.	Inspect engine assembly for fuel, oil, coolant, and other leaks; identify and determine needed repairs.	P-2
3.	Interpret engine noises; determine needed repairs.	P-3
4.	Diagnose the cause of excessive oil consumption, unusual engine exhaust color, odor, and sound; determine needed repairs.	P-3
5.	Diagnose engine mechanical problems; determine needed repairs.	P-2
6.	Perform engine vacuum tests; determine needed repairs.	P-2
7.	Perform cylinder power balance tests; determine needed repairs.	P-3
8.	Perform cylinder compression tests; determine needed repairs.	P-1
9.	Perform cylinder leakage tests; determine needed repairs.	P-2
10.	Remove engine; prepare for tear down.	P-3
11.	Reinstall engine.	P-3

12. Diagnose ignition or fuel problems with an exhaust gas analyzer, an oscilloscope, and/or engine analyzer; determine needed repairs. P-1

13. Perform diagnostic procedures on vehicle with on-board or self-diagnostic type computer systems; determine needed repairs. P-1

14. Perform diagnostic procedures on vehicle computer system using scan tools; determine needed repairs. P-1

15. Inspect and test sensor, actuator components, and circuits of electronic engine management systems; adjust or replace as needed. P-1

I. GASOLINE ENGINES

B. Cylinder Head and Valve Train Diagnosis and Repair

1. Remove and clean cylinder head(s); visually inspect cylinder heads for cracks; check gasket surface areas for warpage and leakage; check passage condition. P-2

2. Install cylinder head(s) and gaskets. P-2

3. Inspect and test valve springs for squareness, tension, and free height comparison; replace as necessary. P-3

4. Inspect valve spring retainers, locks, and valve lock grooves. P-3

5. Replace valve stem seals. P-3

6. Inspect valve guides for wear; check valve guide height and stem-to-guide clearance; recondition/ replace as needed. P-3

7. Inspect valves; resurface or replace as needed. P-3

8. Inspect valve seats; resurface or replace as needed. P-3

9. Check valve face-to-seat contact and valve seat concentricity (runout); service seats and valves as needed. P-3

10. Check valve spring assembled height and valve stem height; service valve and spring assemblies as needed. P-3

11. Inspect pushrods, rocker arms, rocker arm pivots, and shafts for wear, bending, cracks, looseness, and blocked oil passages; repair or replace as needed. P-2

12. Inspect and test hydraulic or mechanical lifters; replace as needed. P-2

13. Adjust valves. P-1

14. Inspect and replace camshaft drives; check gear wear and backlash, sprocket, and chain wear; time camshaft. P-1

15. Inspect and measure camshaft journals and lobes. P-2

I. GASOLINE ENGINES

C. Engine Block Diagnosis and Repair

1. Inspect pans, covers, gaskets, and seals; replace as needed. P-2

2. Inspect engine block for cracks, passage condition, core and gallery plug condition, thread condition, and surface warpage; determine needed repairs. P-2

3. Remove cylinder wall ridges. P-3

4. Inspect and measure cylinder walls for damage and wear; determine needed repairs. P-2

5. Hone and clean cylinder walls. P-3

6. Inspect and measure camshaft bearing bores for wear, damage, out-of-round, and alignment; determine needed repairs. P-3

7. Inspect crankshaft for surface cracks and journal damage; check oil passage condition; measure journal and seal surface wear; determine needed repairs. P-3

8. Inspect and measure main and connecting rod bearings for damage, wear patterns, clearance, and end play; determine needed repairs. P-3

9. Identify piston wear patterns that indicate connecting rod alignment and main bearing bore problems; determine needed repairs. P-3

10. Clean, inspect, and measure pistons; service or replace as needed. P-3

11. Install new piston pins and bushings (as applicable). P-3

12. Inspect, measure, and install piston rings. P-3

13. Inspect crankshaft vibration damper (harmonic balancer); replace as needed. P-2

14. Inspect crankshaft flange and flywheel/flexplate mating surfaces for burrs; measure runout; repair as needed. P-3

15. Inspect flywheel/flexplate for cracks, wear (includes ring gear), and measure runout; determine needed repairs. P-3

16. Reassemble engine using correct gaskets, sealants, and fasteners. P-1

17. Prelube engine lubrication system. P-2

I. GASOLINE ENGINES

D. Lubrication and Cooling Systems Diagnosis and Repair

1. Check engine oil level, condition, and consumption; determine needed repairs. P-1

2. Perform oil pressure tests; determine needed repairs. P-2

3. Inspect and measure oil pumps (includes gears, rotors, and housing), pressure relief devices, and pump drives; replace as needed. P-3

4. Inspect oil pressure regulator valve(s), by-pass and pressure relief valve(s), and filters; repair or replace as needed. P-2

5. Perform cooling system tests (pressure, combustion leakage, and temperature); determine needed repairs. P-2

6. Inspect drive belts and pulleys; replace and adjust as needed. P-1

7. Inspect engine cooling and heater system hoses; replace as needed. P-2

8. Inspect and test thermostat, by-pass, and housing; replace as needed. P-2

9.	Test and inspect coolant; drain, flush, and refill with recommended coolant; bleed cooling system.	P-1
10.	Inspect water pump; replace as needed.	P-2
11.	Inspect and test radiator, pressure cap, and coolant recovery system; replace as needed.	P-1
12.	Clean, inspect, and test fan(s) (electrical and mechanical), fan clutch, fan shroud, and cooling system related temperature sensors/switches; replace as needed.	P-2
13.	Inspect and test oil coolers; determine needed repairs.	P-3
14.	Inspect and test oil temperature/pressure switches and sensors; replace as needed.	P-2
15.	Perform oil and filter change.	P-1

I. GASOLINE ENGINES

E. Ignition System Diagnosis and Repair

1.	Diagnose no-starting, hard starting, engine misfire, poor driveability, excessive emissions, detonation (pinging), power loss, or poor mileage problems on vehicle with electronic ignition systems; determine needed repairs.	P-1
2.	Inspect and test ignition primary circuit wiring and components; repair or replace as needed.	P-2
3.	Remove distributor; inspect and test internal components; reinstall distributor.	P-3
4.	Inspect, test, and service ignition system secondary circuit wiring and components; replace as needed.	P-2
5.	Inspect and test ignition coil; replace as needed.	P-2
6.	Check and adjust ignition system timing; verify timing advance.	P-1
7.	Inspect and test electronic ignition wiring harness and connectors; replace as needed.	P-2
8.	Inspect and test electronic ignition system pick-up sensor or trigger devices; replace as needed.	P-2

9. Inspect and test electronic ignition system control unit (module); replace as needed. P-2

10. Test the operation of spark control system; determine needed repairs. P-2

I. GASOLINE ENGINES

F. Fuel and Exhaust Systems Diagnosis and Repair

1. Diagnose no-starting, hard starting, poor idle, flooding, hesitation, surging, engine misfire, excessive emissions, power loss, poor mileage, and/or dieseling problems on vehicle with carburetor-type fuel systems; determine needed repairs. P-2

2. Diagnose no-starting, hard starting, poor idle, flooding, hesitation, surging, engine misfire, excessive emissions, power loss, poor mileage, and/or dieseling problems on vehicle with injection-type fuel systems; determine needed repairs. P-2

3. Inspect fuel tank, fuel gauge sending unit, fuel tank filter (sock), fuel cap, fuel lines, fuel filters, and hoses; replace as needed. P-2

4. Check fuel quality and condition. P-2

5. Inspect and test (pressure, vacuum, and volume) fuel pumps and pump controls (electrical/ electronic); replace as needed. P-2

6. Inspect, clean, adjust, and test cold-enrichment systems; repair or replace as needed. P-3

7. Remove and reinstall carburetor/fuel injection throttle body; adjust related linkages. P-2

8. Rebuild carburetor (includes disassembling, cleaning, replacing faulty parts, and reassembly). P-3

9. Inspect and clean carburetor mounting plates, fuel injection air induction system, intake manifold, and gaskets; replace as needed. P-3

10. Adjust carburetor idle speed and fuel mixture. P-3

11. Inspect, test, and clean components of fuel injection system; adjust or replace as needed. P-2

12. Inspect air cleaner assembly and filter elements; replace as needed. P-1

13. Perform fuel injector tests (resistance, current, spray pattern, flow, and pressure drop). P-2

14. Inspect and test exhaust manifold, exhaust pipes, mufflers, resonators, tail pipes, catalytic converter, and heat shields; reinstall or replace as needed. P-2

I. GASOLINE ENGINES

G. Emissions Control Systems Diagnosis and Repair

1. Inspect and test the positive crankcase ventilation (PCV) systems; determine needed repairs. P-1

2. Test the operation of the exhaust gas recirculation (EGR) system. P-1

3. Inspect and clean EGR valves, valve manifolds, controls and hoses, and exhaust passages of exhaust gas recirculation (EGR) system; replace as needed. P-2

4. Test the operation of air injection reaction (AIR) system. P-1

5. Inspect and service pumps, pressure relief valves, filters, pulleys, belts, control valves, and vacuum hoses of air injection reaction (AIR) system; replace as needed. P-2

6. Inspect hoses, check valves, air manifolds, and injectors of air injection reaction (AIR) system; replace as needed. P-3

7. Test the operation of fuel vapor control system; determine needed repairs. P-1

8. Inspect liquid/vapor separator, liquid check valve, lines, and hoses of fuel vapor control system; service or replace as needed. P-2

9. Inspect canister, purge lines, and filter of fuel vapor control system; service or replace as needed. P-2

10. Test the operation of inlet air temperature control system; determine needed repairs. P-2

11. Inspect and test early fuel evaporator (EFE) components, sensors, heat stove shroud, hot air pipe, and damper of inlet air temperature control system; replace as needed. P-2

DIESEL ENGINES

For every task in Diesel Engines the following safety task must be strictly enforced as a number 1 priority:

Comply with personal and environmental safety practices associated with clothing, eye protection, hand tools, power equipment and the handling, storage and disposal of chemicals and hazardous materials in accordance with local, state, and federal safety and environmental regulations.

II. DIESEL ENGINES

A. General Engine Diagnosis

1. Listen to and verify operator's complaint; review past maintenance documents; determine needed repairs. P-2
2. Inspect fuel, oil, and coolant levels and condition; determine needed repairs. P-1
3. Inspect engine assembly and compartment for fuel, oil, coolant, air, and other leaks; determine needed repairs. P-2
4. Interpret engine noises; determine needed repairs. P-3
5. Check engine exhaust smoke color and quantity; determine needed repairs. P-2
6. Perform air intake system restriction and/or pressure test; determine needed repairs. P-2
7. Perform manifold pressure and/or air box pressure tests; determine needed repairs. P-2
8. Perform exhaust back pressure tests; determine needed repairs. P-2
9. Perform crankcase pressure test; determine needed repairs. P-2
10. Diagnose no cranking, cranks but fails to start, hard starting, and starts but does not continue to run problems; determine needed repairs. P-1

11. Diagnose surging, rough operation, misfiring, low power, slow deceleration, slow acceleration, and shutdown problems; determine needed repairs. P-2

12. Diagnose engine vibration problems; determine needed repairs. P-2

13. Locate a misfiring cylinder; determine needed repairs. P-1

II. DIESEL ENGINES

B. Cylinder Head and Valve Train Diagnosis and Repair

1. Remove, clean, inspect for visible damage, and replace cylinder head(s) assembly. P-2

2. Clean and inspect threaded holes, studs, and bolts for serviceability; service or replace as needed. P-1

3. Inspect cylinder head and mating surfaces for warpage and thickness; inspect for cracks/damage; check condition of passages; inspect core and gallery plugs; determine needed repairs. P-2

4. Pressure test cylinder head; determine needed repairs. P-3

5. Inspect and test valve springs for squareness, tension, and free height comparison; replace as needed. P-3

6. Inspect valve spring retainers and/or rotators and locks; replace as needed. P-3

7. Measure valve guides for wear, check valve guide-to-stem clearance, and measure valve guide height; replace as needed. P-3

8. Inspect valves; recondition or replace as needed. P-3

9. Inspect valve seats; recondition or replace as needed. P-3

10. Measure valve head height relative to deck, valve face-to-seat contact, and valve seat concentricity; service seats and valves as needed. P-3

11. Inspect injector sleeves and seals; replace; measure injector tip or nozzle protrusion. P-3

12. Clean and inspect precombustion chambers; replace as needed. P-3

13. Inspect valve bridges (crossheads) and guides; replace and adjust bridges as needed. P-3

14. Reassemble cylinder head; vacuum test valve sealing. P-3

15. Inspect, measure, and replace/reinstall overhead camshaft; measure/adjust end play and backlash. P-3

16. Inspect pushrods, rocker arms, rocker arm shafts, and brackets for wear, bending, cracks, looseness, and blocked oil passages; repair or replace as needed. P-2

17. Inspect and adjust cam followers; replace as needed. P-3

18. Adjust valve clearance as needed. P-1

II. DIESEL ENGINES

C. Engine Block Diagnosis and Repair

1. Inspect, service, and install pans, covers, vents, gaskets, seals, and wear rings. P-2

2. Clean engine block; inspect for cracks; measure mating surfaces for warpage; check condition of passages, core, and gallery plugs; inspect threaded holes, studs, dowel pins, and bolts for serviceability; service or replace as needed. P-2

3. Pressure test engine block; determine needed repairs. P-3

4. Inspect cylinder sleeve counterbore and lower bore; check bore distortion; determine needed service. P-3

5. Clean, inspect, and measure cylinder walls or liners for wear and damage; determine needed service. P-3

6. Replace cylinder liners and seals; check and adjust liner height. P-3

7. Inspect camshaft bearings for wear patterns and damage; determine needed repairs. P-3

8. Inspect, measure, and replace/reinstall in-block camshaft; measure/adjust end play. P-3

9. Clean and inspect crankshaft for surface cracks and journal damage; check condition of oil passage(s); check passage plugs; measure journal diameter; determine needed service. P-3

10. Inspect (wear patterns) and replace main bearings; check bearing clearances; check and adjust crankshaft end play. P-3

11. Inspect, replace, and time gear train. P-2

12. Clean, inspect (wear patterns), and measure pistons, pins, retainers, and connecting rods; replace as needed. P-2

13. Measure piston-to-cylinder wall clearance. P-3

14. Check ring-to-groove clearance and end gap; install rings on pistons. P-3

15. Assemble pistons and connecting rods; install in block; replace rod bearings and check clearances. P-2

16. Check piston cooling jets (nozzles) condition, position, and clearances. P-2

17. Inspect, measure, and service crankshaft vibration damper; replace as needed. P-2

18. Inspect, install, and align flywheel housing. P-3

19. Inspect crankshaft flange and flywheel/flexplate mating surfaces for burrs; measure runouts; repair as needed. P-3

20. Inspect flywheel/flexplate for cracks, wear (includes ring gear), and measure runout; determine needed repairs. P-3

II. DIESEL ENGINES

D. Lubrication Systems Diagnosis and Repair

1. Check engine oil pressure, gauge, and sending unit. P-1

2. Check engine oil level, condition, and consumption; determine needed repairs. P-1

3. Inspect, measure, and repair oil pump, drives, inlet pipes, and screens; replace as needed. P-2

4. Inspect oil pressure regulator valve(s), by-pass and pressure relief valve(s), and filters; repair or replace as needed. P-2

5. Inspect, clean, test, reinstall/replace, and align oil cooler; test, reinstall/replace differential valve and thermostat; inspect and repair/replace lines and hoses. P-3

6. Inspect turbocharger lubrication system; determine needed repairs. P-2

II. DIESEL ENGINES

E. Cooling System Diagnosis and Repair

1. Check engine coolant level, condition, and consumption; determine needed repairs. P-1

2. Check coolant temperature, gauge, and sending unit. P-2

3. Inspect drive belts and tensioners; reinstall or replace and adjust as needed. P-1

4. Inspect thermostat, by-passes, housing(s), and seals; replace as needed. P-2

5. Test conditioner and coolant concentration levels; determine needed repairs. P-1

6. Flush and refill cooling system; bleed air from system. P-1

7. Inspect coolant conditioner/filter, check valves, lines, and fittings; replace as needed. P-2

8. Inspect water pump, hoses, and idler pulley; repair or replace as needed. P-2

9. Inspect, clean, and pressure test radiator, pressure cap, and tank(s) and recovery systems; determine needed repairs. P-2

10. Inspect fan hub, fan, fan clutch, controls, thermostat, and fan shroud; repair or replace as needed. P-3

11. Inspect radiator shutter assembly and controls; repair or replace as needed. P-3

II. DIESEL ENGINES

F. Air Induction and Exhaust Systems Diagnosis and Repair

1. Inspect air induction piping, air cleaner, and element; service or replace as needed. P-1

2. Inspect turbocharger, and waste gate/engine driven blowers and piping systems; determine needed repairs. P-2

3. Remove and reinstall turbocharger and waste gate/ engine driven blowers. P-3

4. Inspect intake manifold, gaskets, and connections; repair or replace as needed. P-2

5. Inspect, clean, and test aftercooler (intercooler) and charge air cooler assemblies; repair or replace as needed. P-2

6. Inspect exhaust manifold, piping, mufflers, and mounting hardware; repair or replace as needed. P-2

7. Inspect preheater (glow plug) system and controls; repair or replace as needed. P-3

8. Inspect ether/starting fluid system and controls; repair or replace as needed. P-3

9. Inspect emergency air induction shut-off system; repair or replace as needed. P-3

II. DIESEL ENGINES

G. Fuel System Diagnosis and Repair

1. General Diagnosis and Repair

1. Check fuel level, quality, and consumption; determine needed repairs. P-1

2. Inspect fuel tanks, vents, cap(s), mounts, screens, supply, crossover, and return lines and fittings; determine needed repairs. P-1

3. Inspect, clean, test fuel transfer (lift) pump, pump drives, screens, water separators, filters, heaters, and mounting hardware; determine needed repairs. P-1

4. Check fuel system for air; determine needed repairs. P-1

5. Prime and bleed fuel system; check primer pump; determine needed repairs. P-1

6. Perform on-engine inspections. Remove, test, adjust injectors (and nozzles); determine needed repairs. P-2

7. Inspect high pressure injection lines, fitting, and seals; replace as needed. P-2

8. Inspect low pressure fuel lines, fittings, and seals; repair or replace as needed. P-2

9. Inspect, test, and adjust safety shut-down devices, circuits, and sensors; determine needed repairs. P-3

2. Mechanical Fuel Injection Diagnosis and Repair

1. Perform on-engine inspections, tests, adjustments; check timing or replace and time a distributor (rotary) type injection pump; determine needed repairs. P-2

2. Perform on-engine inspections, tests, adjustments; check timing or replace and time an in-line type injection pump; determine needed repairs. P-2

3. Perform on-engine inspections, tests, and adjustments; replace a PT-type injection pump and injectors as needed. P-2

4. Inspect and adjust throttle control linkage; determine needed repairs. P-1

5. Inspect smoke limiters (air/fuel ratio controls); determine needed repairs. P-3

6. Inspect, test, and adjust engine governors; determine needed repairs. P-3

7. Inspect, test, and adjust engine fuel shut-down devices and controls; determine needed repairs. P-3

3. Electronic Fuel Injection System Diagnosis and Repair

1. Inspect and test power and ground circuits and connections; determine needed repairs. P-1

2. Check DTC (Diagnostic Trouble Codes) from on-board computer system utilizing scan tool and technical information; determine needed repairs. P-2

3. Inspect and replace electrical connector terminals, seals, and locks. P-2

4. Inspect and test sensors, controls, and actuator components and circuits; adjust or replace as needed. P-2

5. Connect computer programming equipment to vehicle/ engine; access and change customer parameters; determine needed repairs. P-3

6. Remove, inspect, test, and reinstall and adjust electronic injectors; determine needed repairs. P-2

7. Perform cylinder power balance utilizing electronic scan tool. P-3

8. Perform engine timing sensor adjustment. P-3

9. Utilizing scan tool, extract engine monitoring information. P-2

10. Download and program an Electrical Control Unit utilizing a PC and a scan tool. P-3

II. DIESEL ENGINES

H. Engine Brakes

1. Inspect and adjust engine brakes; determine needed repairs. P-2

2. Inspect, test, and adjust engine brake control circuits, switches, and solenoids; repair or replace as needed. P-3

3. Inspect engine brake housing, valves, seals, screens, lines, and fittings; repair or replace as needed. P-3

DRIVE TRAIN

For every task in Drive Train the following safety task must be strictly enforced as number 1 priority:

Comply with personal and environmental safety practices associated with clothing, eye protection, hand tools, power equipment and the handling, storage and disposal of chemical and hazardous materials in accordance with local, state, and federal safety and environmental regulations.

III. DRIVE TRAIN

A. Clutch Diagnosis and Repair

1. Diagnose clutch noise, binding, slippage, pulsation, grabbing, and chatter problems; determine needed repairs. P-2

2. Inspect and adjust clutch linkage, cables, levers, brackets, bushings, pivots, and springs (includes push and pull-type assemblies); service or replace as needed. P-2

3. Inspect, adjust, service and replace hydraulic clutch slave and master cylinders; inspect lines and hoses; bleed system. P-2

4. Inspect, adjust, service or replace release (throw-out) bearing; inspect and service sleeve, bushing, springs, levers, shafts, and seals. P-2

5. Inspect and adjust single disc clutch assembly. P-2

6. Inspect, adjust, measure, align or replace double-disc clutch assembly (includes intermediate plate and drive pins). P-2

7. Inspect, adjust, or replace clutch brake assembly; inspect input shaft splines. P-3

8. Inspect self-adjusting clutch mechanisms; determine needed repairs. P-3

9. Inspect and replace pilot bearing. P-2

10. Inspect flywheel mounting area on crankshaft; check crankshaft end play; determine needed repairs. P-2

11. Inspect flywheel and starter ring gear; determine needed repairs. P-2

12. Measure flywheel face runout and pilot bore runout; determine needed repairs. P-2

13. Inspect engine block, flywheel housing, and transmission housing mating surfaces; determine needed repairs. P-2

14. Measure flywheel housing bore runout and face runout; determine needed repairs. P-3

III. DRIVE TRAIN

B. Transmission Diagnosis and Repair

1. Diagnose transmission noise, shifting, lockup, jump-out-of-gear, overheating, and vibration problems; determine needed repairs. P-2

2. Diagnose transmission component failure cause, both before and during disassembly procedures; determine needed repairs. P-3

3.	Inspect, adjust, service, repair, or replace transmission remote shift linkages, brackets, bushings, pivots, and levers.	P-2
4.	Inspect, test, adjust, repair, or replace air shift controls, lines, hoses, valves, regulators, filters, and cylinder assemblies.	P-1
5.	Inspect and replace transmission mounts, insulators, and mounting bolts; determine needed repairs.	P-2
6.	Inspect for leakage and replace transmission cover plates, gaskets, seals, and cap bolts; inspect seal surfaces and vents; determine needed repairs.	P-2
7.	Check transmission fluid level, proper type, and condition; determine needed service.	P-1
8.	Inspect, adjust, and replace transmission shift lever, cover, rails, forks, levers, bushings, sleeves, detentes, interlocks, springs, and lock bolts.	P-3
9.	Remove and reinstall transmission.	P-3
10.	Inspect and replace input shaft, gear, spacers, bearings, retainers, and slingers.	P-3
11.	Inspect and adjust main shaft, gears, sliding clutches, washers, spacers, bushings, bearings, auxiliary drive assemblies, retainers, and keys; replace as needed.	P-3
12.	Inspect countershafts, gears, bearings, retainers, and keys; adjust bearing preload and time multiple countershaft gears; replace as needed.	P-3
13.	Inspect output shafts, gears, washers, spacers, bearings, retainers, and keys; replace as needed.	P-3
14.	Inspect and replace reverse idler shafts, gears, bushings, bearings, thrust washers, and retainers; check reverse idler gear end play (where applicable).	P-3
15.	Inspect and replace synchronizer hub, sleeve, keys (inserts), springs, blocking rings, synchronizer plates, blocker pins, and sliding clutches.	P-3
16.	Inspect or replace transmission cases including surfaces, bores, bushings, pins, studs, and magnets; determine needed repairs.	P-3

17. Inspect transmission lubrication system pumps, troughs, collectors, and slingers; service or replace as needed. P-3

18. Inspect and replace transmission oil filters; inspect coolers. P-2

19. Inspect speedometer components; determine needed repairs. P-2

20. Inspect and adjust power take-off (P.T.O.) assemblies, controls, and power take-off (P.T.O.) shafts; service, repair, or replace as needed. P-3

21. Inspect and test function of backup light, neutral start, and warning device circuit switches; determine needed repairs. P-2

22. Inspect and test transmission temperature gauge; determine needed repairs. P-3

23. Inspect and adjust transfer case assemblies; remove and/or replace as needed. P-3

III. DRIVE TRAIN

C. Drive Shaft and Universal Joint Diagnosis and Repair

1. Diagnose driveshaft and universal joint noise and vibration problems; determine needed repairs. P-2

2. Inspect, service, or replace driveshaft, slip joints, yokes, drive flanges, universal joints; check phasing of all yokes. P-2

3. Inspect, service, repair, and replace driveshaft center support bearings and mounts. P-2

4. Measure and adjust drive line angles. P-2

III. DRIVE TRAIN

D. Drive Axle Diagnosis and Repair

1. Diagnose rear axle(s) drive unit noise and overheating problems; determine needed repairs. P-2

2. Check for and repair fluid leaks; inspect and replace rear axle(s) drive unit cover plates, gaskets, vents, magnetic plugs, and seals. P-2

3.	Check rear axle(s) drive unit fluid level and condition; determine needed service and add proper type of lubricant.	P-1
4.	Remove and replace differential carrier assembly.	P-3
5.	Inspect and replace differential case assembly including spider gears, cross shaft, side gears, thrust washers, case halves, and bearings.	P-3
6.	Inspect and replace components of traction control (limited slip) differential case assembly.	P-3
7.	Inspect differential carrier case and caps, side bearing bores, and pilot bearing bore; determine needed service.	P-3
8.	Measure ring gear runout; determine needed repairs.	P-2
9.	Inspect and replace ring and drive pinion gears, spacers, sleeves, bearing cage, and bearings.	P-3
10.	Measure and adjust drive pinion bearing preload.	P-3
11.	Adjust drive pinion depth.	P-3
12.	Measure and adjust side bearing preload and ring pinion backlash.	P-3
13.	Check and interpret ring and pinion tooth contact pattern; determine needed repairs.	P-2
14.	Inspect, adjust, or repair ring gear thrust block/ screw.	P-3
15.	Inspect, adjust, repair, or replace planetary gear-type 2-speed axle assembly including: case, idler pinion, pins, thrust washers, sliding clutch gear, shift fork, pivot, seals, cover, and springs.	P-3
16.	Inspect, repair, or replace 2-speed axle shift control system speedometer adapters, motors, axle shift units, wires, air lines, and connectors.	P-2
17.	Inspect power divider (inter-axle differential) assembly; determine needed repairs.	P-3
18.	Inspect, adjust, repair, or replace air operated power divider (inter-axle differential) lockout assembly including diaphragms, seals, springs, yokes, pins, lines, hoses, fittings, and controls.	P-2

19. Inspect, repair, or replace rear axle lubrication system pump, troughs, collectors, slingers, tubes, and filters. P-3

20. Inspect and replace rear axle shafts. P-2

21. Remove and replace wheel assembly; check rear wheel seal and axle flange gasket for leaks; determine needed repairs. P-2

22. Diagnose rear wheel bearing noises and damage; determine needed repairs. P-2

23. Inspect and test rear axle temperature gauge sensor; determine needed repairs. P-3

SUSPENSION AND STEERING

For every task in Suspension and Steering the following safety task must be strictly enforced as a number 1 priority:

Comply with personal and environmental safety practices associated with clothing, eye protection, hand tools, power equipment and the handling, storage and disposal of chemicals and hazardous materials in accordance with local, state, and federal safety and environmental regulations.

IV. SUSPENSION AND STEERING

A. Steering Systems Diagnosis and Repair

1. Steering Column and Manual Steering Gear

1. Diagnose steering system problems, column and shaft noise, looseness, and binding problems; determine needed repairs. P-2

2. Inspect steering shaft U-joint(s), slip joints, bearings, bushings, and seals; phase shaft U-joints; replace as needed. P-2

3. Diagnose manual steering gear noise, binding, uneven turning effort, looseness, hard steering, and lubricant leakage problems; determine needed repairs. P-3

4. Inspect lubricant for proper type, level, and condition; determine needed service. P-3

5. Inspect manual steering gear bushings, bearings, shafts, seals, gaskets, and mounting bolts; service, repair or replace as needed. P-3

6. Adjust manual steering gear worm bearing preload. P-3

7. Determine center position (high point) of pitman (cross) shaft; adjust sector shaft lash. P-3

2. Power Steering Systems

1. Diagnose power steering system problems: noises, steering binding, uneven turning effort, looseness, hard steering, overheating, fluid leakage, and fluid aeration problems; determine needed repairs. P-1

2. Inspect power steering fluid type, level, and condition; determine needed service. P-1

3. Purge power steering system. P-2

4. Perform power steering system pressure and flow tests; determine needed repairs. P-2

5. Inspect power steering reservoir including filter, seals, and gaskets; service or replace as needed. P-2

6. Inspect, adjust, and align power steering pump belt(s), pulley(s), and tensioner(s); replace as needed. P-1

7. Inspect power steering pump drive gear and coupling; replace as needed. P-3

8. Inspect power steering pump, mountings, and brackets; replace as needed. P-3

9. Inspect power steering pump pressure regulator valves; replace as needed. P-3

10. Inspect power steering system cooler, lines, hoses, and fittings; replace as needed. P-3

11. Inspect and adjust linkage assist-type power steering control and remote relief valves; repair or replace as needed. P-3

12. Inspect and adjust linkage assist-type power steering cylinder; replace as needed. P-3

13. Inspect and adjust integral-type power steering gear, worm gear preload and sector shaft; inspect and adjust poppet valves; repair or replace as needed. P-1

14. Inspect and adjust dual power steering gear systems; replace as needed. P-3

15. Inspect power steering gear, seals, and gaskets; replace as needed. P-2

3. Steering Linkage

1. Inspect pitman arm; replace as needed. P-2

2. Inspect and adjust drag link and tie rod; replace as needed. P-2

3. Inspect and adjust drag link and tie rod ends (ball and socket type); replace as needed. P-2

4. Inspect steering arm and levers and linkage pivot joints; replace as needed. P-1

5. Inspect and position as needed, clamps and retainers; replace as needed. P-1

6. Check steering linkage or wheel stops; adjust as needed. P-1

IV. SUSPENSION & STEERING

B. Suspension Systems Diagnosis and Repair

1. Diagnose ride problems. P-2

2. Inspect front axles, U-bolts, and nuts; determine needed repairs. P-1

3. Inspect and service king pin, steering knuckle bushings, locks, bearings, seals, and covers; determine needed repairs. P-1

4. Inspect shock absorbers, bushings, brackets, and mounts; replace as needed. P-2

5. Inspect leaf springs, center bolts, clips, eye bolts and bushings, shackles, slippers, insulators, brackets, and mounts; determine needed service and repairs. P-1

6. Inspect torsion bars, bell cranks, ratchets, bushings, bearings, and mounting brackets; determine needed service and repairs. P-3

7. Inspect torque arms, bushings, and mounts; determine needed repairs. P-2

8. Inspect axle aligning devices such as radius rods, track bars, stabilizer bars, and bushings, mounts, shims, and cams; determine needed repairs. P-2

9. Inspect walking beams, center (cross) tube, bushings, mounts, load pads, and saddles/caps; replace as needed. P-3

10. Inspect and test air suspension pressure regulator and height control valves, lines, hoses, dump valves, and fittings; adjust, repair or replace as needed. P-2

11. Inspect and test air springs, mounting plates, springs, suspension arms, and bushings; replace as needed. P-2

12. Measure vehicle frame angle (ride height); determine needed repairs. P-2

IV. SUSPENSION & STEERING

C. Wheel Alignment Diagnosis, Adjustment, and Repair

1. Diagnose vehicle wandering, pulling, shimmy, and hard steering problem(s); adjust and repair as needed. P-2

2. Check camber and KPI (king pin inclination); determine needed repairs. P-2

3. Check caster; adjust or repair as needed. P-2

4. Check toe; adjust as needed. P-1

5. Check rear axle(s) alignment (thrustline/centerline) and tracking; adjust or repair as needed. P-2

6. Diagnose turning/Ackerman angle (toe-out-on-turns) problems; determine needed repairs. P-3

IV. SUSPENSION & STEERING

D. Wheels and Tires Diagnosis and Repair

1.	Diagnose unusual tire wear patterns; determine needed repairs.	P-1
2.	Diagnose wheel/tire vibration, shimmy, pounding, hop (tramp) problems; determine needed repairs.	P-2
3.	Inspect wheels, rims, spacers, clamps, studs, and nuts; replace as needed.	P-1
4.	Inspect tire and wheel assemblies in accordance with manufacturers' recommended procedures.	P-2
5.	Measure wheel and tire radial and lateral runout; adjust or repair as needed.	P-2
6.	Inspect tires; check air pressure.	P-1
7.	Perform static balance of wheel and tire assembly.	P-3
8.	Perform dynamic balance of wheel and tire assembly.	P-3
9.	Measure tire diameter; match tires on tandem axle(s).	P-1
10.	Clean, inspect, lubricate, and adjust wheel bearings; replace seals and wear rings; replace as needed.	P-1

1. Related Components

1.	Inspect and service fifth wheel assemblies and pintle hitch; determine needed repairs.	P-2
2.	Inspect frame and frame members for cracks, breaks, distortion (alignment), elongated holes, looseness, and damage; determine needed repairs.	P-2
3.	Inspect, install, or repair frame, hangers, brackets, and crossmembers.	P-3
4.	Inspect, test, and adjust cab air suspension components: lines, hoses, fittings, air springs, bushings, shocks, valves, and linkage; determine needed repairs.	P-2
5.	Inspect, test, and adjust driver's air seat components; determine needed repairs.	P-3

6. Check thrust angle (tracking). P-3

7. Inspect fifth wheel plate and pin (trailer). P-3

BRAKES

For every task in Brakes the following safety task must be strictly enforced as a number 1 priority:

Comply with personal and environmental safety practices associated with clothing, eye protection, hand tools, power equipment and the handling, storage and disposal of chemicals and hazardous materials in accordance with local, state, and federal safety and environmental regulations.

V. BRAKES

A. Air Brakes Diagnosis and Repair

1. Air Supply and Service Systems

1. Diagnose poor stopping, air leaks, pulling, grabbing, or dragging problems caused by supply and service system malfunctions; determine needed repairs. P-2

2. Check air system build-up time; determine needed repairs. P-1

3. Drain air reservoir tanks; check for oil, water, and foreign material; determine needed repairs. P-1

4. Inspect, adjust, and align compressor drive belts, pulleys, and tensioners; replace as needed. P-2

5. Inspect and time compressor drive gear and coupling; replace as needed. P-3

6. Inspect air compressor, air cleaner/supply, and oil and water lines and fittings; repair or replace as needed. P-2

7. Inspect, test, and adjust system pressure controls (governor/relief valve), unloader assembly valves, filters, lines, hoses, and fittings; replace as needed. P-2

8. Inspect air system lines, hoses, fittings, and couplings; repair or replace as needed. P-2

9. Inspect, test, and clean air tank relief (pop-off) valves, one-way check valves, drain cocks, spitter valves, heaters, wiring, and connectors; replace as needed.	P-2
10. Inspect and clean air drier systems, filters, valves, heaters, wiring, and connectors; repair or replace as needed.	P-2
11. Inspect and test brake application (foot) valve, fittings, and mounts; adjust or replace as needed.	P-2
12. Inspect, test, and clean two-way check valves; replace as needed.	P-2
13. Inspect and test stop and parking brake light circuit switches, wiring, and connectors; repair or replace as needed.	P-3
14. Inspect and test hand brake (trailer) control valve, lines, fittings, and mountings; repair or replace as needed.	P-2
15. Inspect and test brake relay valve; replace as needed.	P-2
16. Inspect and test quick release valves; replace as needed.	P-2
17. Inspect and test front and rear axle limiting; (proportioning) valves; replace as needed.	P-2
18. Inspect and test tractor protection valve; replace as needed.	P-2
19. Inspect and test emergency (spring) brake control valve(s) and inversion valve; replace as needed.	P-1
20. Inspect and test low pressure warning devices, wiring, and connectors; replace as needed.	P-1
21. Inspect and test air pressure gauges, lines, and fittings; replace as needed.	P-3

2. Mechanical/Foundation

1. Diagnose poor stopping, brake noise, pulling, grabbing, or dragging complaints caused by foundation brake, slack adjuster, and brake chamber problems; determine needed repairs.	P-2

2. Inspect, test, adjust, and service brake chambers, diaphragm, clamp, spring, pushrod, clevis, and mounting brackets; repair or replace as needed. P-2

3. Inspect and service manual and automatic slack adjusters; adjust or replace as needed. P-1

4. Inspect cams, rollers, shafts, bushings, seals, spacers, and retainers; service or replace as needed. P-2

5. Inspect brake spider, shields, anchor pins, bushings, and springs; service or replace as needed. P-2

6. Inspect wedge brake spider, manual and automatic adjuster plungers, housing, and wedge assembly; repair or replace as needed. P-3

7. Inspect, clean, and adjust air disc brake caliper assemblies; determine needed repairs. P-3

8. Inspect brake shoes or pads; replace as needed. P-2

9. Inspect and measure brake drums or rotors; determine needed repairs. P-2

3. Parking Brakes

1. Inspect drive line parking brake drums, rotors, bands, shoes, mounting hardware, and adjusters; adjust, repair, or replace as needed. P-2

2. Inspect drive line parking brake application system pedal, cables, linkage, levers, pivots, and springs; adjust, repair, or replace as needed. P-2

3. Check operation of parking (spring) brake chamber; determine needed repairs. P-2

4. Inspect and test parking (spring) brake check valves, lines, hoses, and fittings; replace as needed. P-2

5. Inspect and test parking (spring) brake application and release valve; replace as needed. P-2

6. Manually release and reset parking (spring) brakes in accordance with manufacturers' recommendations. P-2

4. Anti-lock Brake Systems

1. Inspect, test, and service anti-lock brake system (ABS) air, electrical/electronic, and mechanical components.	P-2
2. Diagnose poor stopping, wheel lock-up, pulsation, and noise problems caused by the anti-lock brake system (ABS); determine needed repairs.	P-2
3. Observe anti-lock brake system (ABS) warning light at startup; determine if further diagnosis is needed.	P-2
4. Diagnose anti-lock brake system (ABS) electronic control(s) and components using self-diagnosis and/or recommended test equipment; determine needed repairs.	P-2
5. Service, test, and adjust anti-lock brake system (ABS) speed sensors following manufacturer's recommended procedures.	P-2

V. BRAKES

B. Hydraulic Brakes Diagnosis and Repair

1. Hydraulic System

1. Diagnose poor stopping, pulling, or dragging problems caused by the hydraulic system; determine needed repairs.	P-2
2. Test hydraulic system; inspect for leaks.	P-2
3. Check and adjust brake pedal pushrod length.	P-3
4. Inspect and test master cylinder; determine needed repairs.	P-2
5. Inspect, test, or replace brake lines, flexible hoses, and fittings.	P-2
6. Inspect and test metering (hold-off), proportioning, and combination valves; replace as needed.	P-2
7. Inspect and test brake pressure differential valve and warning light circuit switch, bulbs, wiring, and connectors; repair or replace as needed.	P-1
8. Inspect wheel cylinders; determine needed repairs.	P-2

9. Inspect disc brake caliper assemblies; determine needed repairs. P-2

10. Bleed and/or flush hydraulic system. P-1

11. Inspect and test hydraulic parking brake systems; repair or replace as needed. P-3

2. Mechanical System

1. Diagnose poor stopping, noise, pulling, grabbing, dragging, or pedal pulsation problems caused by drum and disc brake mechanical assembly; determine needed repairs. P-2

2. Inspect and measure brake drums or rotors; determine needed repairs. P-2

3. Inspect drum brake shoes, mounting hardware, adjuster mechanisms, and backing plates; replace as needed. P-2

4. Inspect disc brake pads and mounting hardware; replace as needed. P-2

3. Power Assist Units and Related Components

1. Diagnose poor stopping problems caused by power brake booster(s); determine needed repairs. P-2

2. Inspect and test power brake booster(s), hoses, and control valves; replace as needed. P-2

3. Test and adjust brake stop light switch, bulbs, wiring, and connectors; repair or replace as needed. P-2

4. Check emergency (stand-by) hydraulic boost system. P-2

4. Anti-lock Brake Systems

1. Inspect, test, and service anti-lock brake system (ABS) air, electrical/electronic, and mechanical components. P-2

2. Diagnose poor stopping, wheel lock-up, pulsation, and noise problems caused by the anti-lock brake system (ABS); determine needed repairs. P-2

3. Observe anti-lock brake system (ABS) warning light at startup; determine if further diagnosis is needed. P-2

4. Diagnose anti-lock brake system (ABS) electronic control(s) and components using self-diagnosis and/or recommended test equipment; determine needed repairs. P-2

5. Service, test, and adjust anti-lock brake system (ABS) speed sensors following manufacturer's recommended procedures. P-2

ELECTRICAL/ELECTRONIC SYSTEMS

For every task in Electrical/Electronic Systems the following safety task must be strictly enforced as a number 1 priority:

Comply with personal and environmental safety practices associated with clothing, eye protection, hand tools, power equipment and the handling, storage and disposal of chemicals and hazardous materials in accordance with local, state, and federal safety and environmental regulations.

VI. ELECTRICAL/ELECTRONIC SYSTEMS

A. General Electrical Systems Diagnosis

1. Check continuity in electrical/electronic circuits using appropriate test equipment and wiring diagrams. P-1

2. Check applied voltages, circuit voltages, and voltage drops in electrical/electronic circuits using a digital multimeter (DMM). P-1

3. Check current flow in electrical/electronic circuits and components using an ammeter. P-1

4. Check resistance in electrical/electronic circuits and components using an ohmmeter. P-1

5. Find shorts, grounds, and opens in electrical/electronic circuits. P-1

6. Diagnose key-off battery drain problems. P-1

7. Inspect and test fusible links, circuit breakers, relays, solenoids, and fuses; replace as needed. P-2

8. Inspect and test spike suppression diodes/resistors; replace as needed. P-3

VI. ELECTRICAL/ELECTRONIC SYSTEMS

B. Battery Diagnosis and Repair

1. Perform battery hydrometer test; determine specific gravity of each cell.	P-3
2. Perform battery capacity (load, high rate discharge) test; determine needed service.	P-1
3. Determine battery state of charge by measuring terminal post voltage using a DMM.	P-2
4. Inspect, clean, and service battery; replace as needed.	P-2
5. Inspect and clean battery boxes, mounts, and hold downs; repair or replace as needed.	P-2
6. Charge battery using slow or fast charge method as appropriate.	P-2
7. Inspect and clean battery cables and connectors; repair or replace as needed.	P-2
8. Jump start a vehicle using jumper cables and a booster battery or auxiliary power supply using proper safety procedures.	P-2

VI. ELECTRICAL/ELECTRONIC SYSTEMS

C. Starting System Diagnosis and Repair

1. Perform starter current draw test; determine needed repairs.	P-1
2. Perform starter circuit voltage drop tests; determine needed repairs.	P-1
3. Inspect, test, and replace components and wires in the starter control circuit.	P-2
4. Remove and replace starter.	P-3
5. Inspect, test, and replace starter relays and solenoids/switches.	P-2

VI. ELECTRICAL/ELECTRONIC SYSTEMS

D. Charging System Diagnosis and Repair

1. Diagnose dash mounted charge meters and/or indicator lights that show a no charge, low charge, or overcharge condition; determine needed repairs.	P-2
2. Diagnose the cause of a no charge, low charge, or overcharge condition; determine needed repairs.	P-1
3. Inspect, adjust, and replace alternator drive belts, pulleys, fans, and mounting brackets.	P-1
4. Inspect and replace alternator drive gears and couplings.	P-3
5. Perform charging system output test; determine needed repairs.	P-1
6. Perform charging circuit voltage drop tests; determine needed repairs.	P-1
7. Remove and replace alternator.	P-3
8. Inspect, repair, or replace connectors and wires in the charging circuit.	P-2
9. Diagnose 12/24 volt alternator charging system problems; determine needed repairs.	P-3

VI. ELECTRICAL/ELECTRONIC SYSTEMS

E. Lighting Systems Diagnosis and Repair

1. Headlights, Parking, Clearance, Tail, Cab, and Dash Lights

1. Diagnose the cause of brighter than normal, intermittent, dim, or no headlight operation.	P-2
2. Test, aim, and replace headlights.	P-2
3. Test headlight and dimmer switches and relays, wires, terminals, connectors, and sockets; repair or replace as needed.	P-2
4. Inspect and test switches, bulbs, sockets, connectors, terminals, and wires of parking, clearance, and taillight circuits; repair or replace as needed.	P-2

5. Inspect and test dash light circuit switches and relays, bulbs, sockets, connectors, terminals, wires, and printed circuits/control modules; repair or replace as needed. P-2

6. Inspect and test interior cab light circuit switches, bulbs, sockets, connectors, terminals, and wires; repair or replace as needed. P-2

7. Inspect and test tractor to trailer multi-wire connector; repair or replace as needed. P-2

2. Stoplights, Turn Signals, Hazard Lights, and Back-up Lights

1. Inspect, test, and adjust stoplight circuit switches, bulbs, sockets, connectors, terminals, and wires; repair or replace as needed. P-2

2. Diagnose the cause of turn signal and hazard flasher lights problems. P-2

3. Inspect and test turn signal and hazard circuit flasher, switches, relays, bulbs, sockets, connectors, terminals, and wires; repair or replace as needed. P-2

4. Inspect, test, and adjust back-up light and warning device circuit switches, bulbs, sockets, horns, buzzers, connectors, terminals, and wires; repair or replace as needed. P-2

VI. ELECTRICAL/ELECTRONIC SYSTEMS

F. Gauges and Warning Devices Diagnosis and Repair

1. Diagnose the cause of intermittent, high, low, or no gauge readings; determine needed repairs. P-2

2. Test and replace gauge-circuit voltage regulators (limiters). P-3

3. Inspect, test, and adjust gauge circuit sending units, gauges, connectors, terminals, and wires; repair or replace as needed. P-2

4. Inspect and test warning light circuit sending units, bulbs, sockets, connectors, wires, and printed circuits/control modules; repair or replace as needed. P-2

5. Inspect and test warning buzzer circuit sending units, buzzers, switches, relays, connectors, terminals, wires, and printed circuits/control modules; repair or replace as needed. P-2

6. Inspect, test, replace, and calibrate electronic speedometer, odometer, and tachometer systems. P-2

1. Related Electrical Components

1. Diagnose the cause of constant, intermittent, or no horn operation. P-2

2. Inspect and test horn circuit relays, horns, switches, connectors, and wires; repair or replace as needed. P-2

3. Diagnose the cause of constant, intermittent, or no wiper operation; diagnose the cause of wiper speed control and/or park problems. P-2

4. Inspect and test wiper motor, resistors, park switch, relays, switches, connectors, and wires; repair or replace as needed. P-2

5. Inspect and replace wiper motor transmission linkage, arms, and blades. P-2

6. Inspect and test windshield washer motor or pump/ relay assembly, switches, connectors, terminals, and wires; repair or replace as needed. P-3

7. Inspect and test mirror; heater circuit grids, motors, relays, switches, connectors, and wires; repair or replace as needed. P-3

8. Inspect and test heater and A/C electrical components including: A/C clutch motors, resistors, relays, switches, connectors, terminals, and wires; repair or replace as needed. P-3

9. Inspect and test cigarette lighter case, integral fuse, connectors, terminals, and wires; repair or replace as needed. P-3

10. Diagnose the cause of slow, intermittent, or no power side window operation. P-3

11. Inspect and test motors, switches, relays, connectors, terminals, and wires of power side window circuits; repair or replace as needed. P-3

12. Inspect block heaters; determine needed repairs. P-2

HEATING AND AIR CONDITIONING

For every task in Heating and Air Conditioning the following safety task must be strictly enforced as a number 1 priority:

Comply with personal and environmental safety practices associated with clothing, eye protection, hand tools, power equipment and the handling, storage and disposal of chemicals and hazardous materials in accordance with local, state, and federal safety and environmental regulations.

VII. HEATING AND AIR CONDITIONING

All practices and procedures must be performed according to current mandates, standards, and regulations.

A. A/C System Diagnosis and Repair

1. Diagnose the cause of unusual operating noises of the A/C system; determine needed repairs. P-2

2. Identify system type and conduct performance test of the A/C system; determine needed repairs. P-1

3. Diagnose A/C system problems indicated by refrigerant flow past the sight glass (for systems using a sight glass); determine needed repairs. P-2

4. Diagnose A/C system problems indicated by pressure gauge readings; determine needed repairs. P-1

5. Diagnose A/C system problems indicated by visual and touch procedures; determine needed repairs. P-2

6. Leak test A/C system; determine needed repairs. P-1

7. Evacuate A/C system. P-1

8. Clean A/C system components and hoses; in accordance with required procedures. P-2

9. Charge A/C system with required refrigerant (liquid or vapor). P-2

VII. HEATING & AIR CONDITIONING

B. Refrigeration System Component Diagnosis and Repair

1. Compressor and Clutch

1. Diagnose A/C system problems that cause the pressure protection devices to interrupt system operation; determine needed repairs.	P-2
2. Inspect A/C system pressure protection devices (including engine fan controls); determine needed repairs.	P-2
3. Inspect and adjust A/C compressor drive belts and pulleys; determine needed repairs.	P-1
4. Inspect and test A/C compressor clutch components or assembly; replace as needed.	P-2
5. Inspect and adjust oil level in A/C compressor.	P-2
6. Inspect and test A/C compressor; replace as needed.	P-3
7. Inspect A/C compressor mountings; repair or replace as needed.	P-3

2. Evaporator, Condenser, and Related Components

1. Inspect A/C system mufflers, hoses, lines, filters, fittings, and seals; repair or replace as needed.	P-2
2. Inspect A/C condenser for air flow restrictions; clean and straighten fins.	P-2
3. Inspect, test, and replace A/C system condenser and mountings.	P-3
4. Inspect receiver/drier; replace as needed.	P-2
5. Inspect accumulator/drier in orifice tube A/C systems; replace as needed.	P-2
6. Inspect and test expansion valve; replace as needed.	P-2
7. Inspect and test orifice tube (including filter); replace as needed.	P-2
8. Inspect, test, and clean evaporator; replace as needed.	P-3

9. Inspect and clean evaporator housing and water drain; repair as needed. P-3

10. Identify and inspect A/C system service valves (gauge connections); replace as needed. P-2

11. Inspect A/C system high pressure relief device; replace as needed. P-3

VII. HEATING AND AIR CONDITIONING

C. Heating System Diagnosis and Repair

1. Diagnose the cause of temperature control problems in the heater/ventilation/air conditioning system; determine needed repairs. P-2

2. Diagnose window fogging problems; determine needed repairs. P-3

3. Perform cooling system tests; determine needed repairs. P-3

4. Inspect and replace heater system hoses; assure correct routing. P-3

5. Inspect, test, and replace thermostat, by-pass, and housing. P-3

6. Inspect and test heater coolant control valve (manual, vacuum, air, or electrical types); replace as needed. P-2

7. Inspect and flush heater core; replace as needed. P-3

VII. HEATING AND AIR CONDITIONING

D. Operating Systems and Related Controls Diagnosis and Repair

1. Electrical

1. Diagnose the electrical and electronic control system of heating, ventilating, and A/C systems; determine needed repairs. P-2

2. Inspect, test, repair, and replace A/C-heater blower motors, resistors, switches, relay/modules, wiring, and protection devices. P-2

3. Inspect, test, repair, and replace A/C compressor clutch control devices (relay/modules, wiring, sensors, switches, diodes, and protection devices). P-2

2. Vacuum/Mechanical/Air

1. Diagnose the controls of the heating, ventilating, and A/C systems; determine needed repairs.	P-3
2. Inspect, test, and service heating, ventilating, and A/C control panel assemblies; replace as needed.	P-3
3. Inspect, test, and adjust heating, ventilating, and A/C control cables and linkages; replace as needed.	P-3
4. Inspect, test, and adjust heating, ventilating, and A/C ducts, doors, hoses, and outlets; repair or replace as needed.	P-3
5. Diagnose temperature control system problems; determine needed repairs.	P-3
6. Diagnose blower system problems; determine needed repairs.	P-2
7. Diagnose air distribution system problems; determine needed repairs.	P-3
8. Inspect, test, and adjust climate control temperature sensor systems; replace as needed.	P-3
9. Inspect and test heater valve and controls; replace as needed.	P-2
10. Inspect and test electric, vacuum, or air motors, solenoids, and switches; replace as needed.	P-3

VII. HEATING AND AIR CONDITIONING

E. Refrigerant Recovery, Recycling, and Handling

1. Verify correct operation of refrigerant handling equipment.	P-1
2. Identify and recover A/C system refrigerant.	P-1
3. Recycle refrigerant.	P-1
4. Label and store refrigerant.	P-1
5. Test recycled refrigerant for non-condensable gases.	P-1

PREVENTIVE MAINTENANCE INSPECTION

For every task in Preventive Maintenance Inspection the following safety task must be strictly enforced as a number 1 priority:

Comply with personal and environmental safety practices associated with clothing, eye protection, hand tools, power equipment and the handling , storage and disposal of chemicals and hazardous materials in accordance with local, state, and federal safety and environmental regulations.

VIII. PREVENTIVE MAINTENANCE INSPECTION

The tasks included in the Preventive Maintenance Inspection area are entry level technician inspection tasks designed to introduce the student to correct procedures and practices of vehicle inspection in a teaching/learning environment. They are not intended to satisfy the Annual Federal Vehicle Inspection requirement as prescribed in the *Federal Motor Carrier Safety Regulations, Part 396, Appendix G to Subchapter B, Minimum Periodic Inspection Standards*.

The first task in Preventive Maintenance is to listen to and verify operator's complaints, review past maintenance documents, and determine needed repairs.

A. Cab and Body

1. Inspect gauges and indicators for proper operation.	P-1
2. Check DOT safety equipment for availability and condition.	P-1
3. Check accessories for proper operation.	P-1
4. Check condition of interior components including seats and upholstery. Check operation.	P-1
5. Make visual inspection of cab exterior and body for damage or missing components.	P-1
6. Check air pressure drop.	P-1
7. Compare air pressure build-up time with original equipment specifications.	P-1
8. Check steering wheel free-play.	P-1
9. Check pedal and accelerator operation.	P-1

VIII. PREVENTIVE MAINTENANCE INSPECTION

B. Tires and Wheels

1.	Inspect tires for wear patterns, condition, and air pressure; record tread depth.	P-1
2.	Check rim/wheel condition (bends, cracks).	P-1
3.	Check spacers, clamps, rings, studs, and nuts for cracks, damage, and indications of looseness.	P-1
4.	Inspect wheel lug nuts for rust, elongation, or wear indicators that would indicate improper torque.	P-1
5.	Inspect outer hubs for oil leaks.	P-1
6.	Check wheel bearings for free-play.	P-1

VIII. PREVENTIVE MAINTENANCE INSPECTION

C. Engine Compartment

1.	Inspect fluid reservoirs for correct levels and condition.	P-1
2.	Check compartment for leaks (fuel, air, coolant, exhaust).	P-1
3.	Check alternator, air-conditioning compressor, starter, engine, and air compressor mounts for tightness and wear.	P-1
4.	Check hoses and lines (air, water, fuel, power steering, air-conditioning) for wear and tightness.	P-1
5.	Check belts for tightness and wear.	P-1
6.	Check electrical wiring, routing, and hold-down clamps.	P-1
7.	Inspect air intake system (mounts, hoses, clamps, restriction indicators, turbo) for leaks, damage, and restrictions.	P-1
8.	Listen and note unusual noises.	P-1
9.	Check optional equipment for proper operation.	P-1
10.	Check air-conditioning condenser, radiator, and after-coolers for air flow restriction.	P-1

VIII. PREVENTIVE MAINTENANCE INSPECTION

D. Electrical/Electronic

1. Inspect condition of batteries, battery boxes, mountings, and hold-downs.	P-1
2. Inspect condition of battery cables, ends, looms, relays, solenoids, starter wiring, and ground connections.	P-1
3. Check starter and solenoid for proper operation and mounting.	P-1
4. Check condition and operation of charging system including: alternator, mounting brackets, wiring, and belt condition, tension, and alignment.	P-1
5. Check truck and trailer lighting systems for operation, mounting, and condition.	P-1
6. Check operation of dash gauges, dash lights, cab interior lights, wipers, blower fans, turn signals, flashers, air-conditioning, horn, radio, and optional equipment.	P-1
7. Check diagnostic displays for proper operation.	P-1

VIII. PREVENTIVE MAINTENANCE INSPECTION

E. Chassis/Undercarriage

1. Check manual/power steering system and linkage for noises, looseness, binding, hard steering, and fluid leakage.	P-1
2. Inspect front and rear axles and suspension components for wear and damage.	P-1
3. Check clutch adjustment.	P-1
4. Inspect clutch linkage for looseness or binding.	P-1
5. Inspect leaf springs, U-bolts, nuts, bushings, shackles, and mounts for looseness and damage.	P-1
6. Inspect air springs, mounts, hoses, and fittings for leaks and damage.	P-1
7. Check mounts; check transmission for leaks and correct fluid levels.	P-1

8.	Inspect transmission shift components for leaks and damage.	P-1
9.	Inspect driveshaft and yokes for alignment (phasing), wear, and damage.	P-1
10.	Inspect brake system air tanks, lines, fittings, valves, brake chambers, and slack adjusters for leaks, damage, and looseness; check mounts.	P-1
11.	Inspect fifth wheel assembly for condition, mounting, and proper operation.	P-1
12.	Check brake adjustment.	P-1
13.	Check brake lining condition, wheel seals, drums, and rotors for wear and damage.	P-1

TOOLS AND EQUIPMENT

Local employment opportunities and the availability of funds are key factors for determining the program's structure and operation. This selection was developed recognizing that in the majority of programs, all of the tasks and specialty areas cannot be covered. Therefore, the basic philosophy is this: For the tasks which are covered, the training should be as thorough as possible.

The basic tools and equipment the lab/shop and student should have for training on any given specialty area are included in this section. Obviously, many tools and much equipment are the same for some or all of the specialty areas. Some equipment is specialized, however, and must be available in the lab/shop to provide quality training. No specific brand names are identified because they will vary in each local situation.

The student hand tool list covers all areas, and indicate the tools a student will need to be successful in each of the specialty areas. Industry surveys indicate that most (90%) employers require that a candidate for employment provide his/her own basic hand tool set in order to be hired as an entry level truck technician.

HAND TOOLS
CONTAINED IN INDIVIDUAL SETS OR TOOL CRIB
(IN SUFFICIENT QUANTITIES TO PERMIT EFFICIENT INSTRUCTION)

Allen Wrench Set - Standard
(.050" - 3/8")
(7/16" - 1/2" optional)
Allen Wrench Set - Metric (2mm - 12mm)
Battery Nut Pliers
Battery Post Cleaner
Battery Terminal Adapter
Battery Terminal Clamp Puller
Chisels - Cape 5/16"
Cold 5/8", 3/4"
Combination Wrenches - Standard (3/8" - 1")
(up to 1 and 1/4" optional)
Metric (6mm - 19mm) (up to 24 mm optional)
Digital Multimeter - at least 10 meg. ohms impedance
Electrical Pliers - Cripper/Stripper
Files and Handles - 4", 10", and 12" Fine
6" and 12" Coarse
6" and 12" Half Round
Flare Nut Wrench Set - Standard (3/8" - 3/4")
Metric (7mm - 19mm)
Flashlight
Goggles - (per OSHA requirements)
Hack Saw
Hammers - Ball Peen - 16 oz. and 24 oz.
Soft Face
Hearing Protection - (per OSHA requirements)
Inspection Mirror
Magnetic Pickup Tool
Mechanic's Steel Ruler - Machinist Rue
Pliers - Channel Lock
Locking Pliers
Needle Nose
Side Cutters
Slip-joint
Punches - Pin 3/16" - 3/8"
Starter 3/16" - 3/8"
Aligning Punch Set
Brass punch
Center punch
Safety Glasses (Side Panels) - (per OSHA requirements)
Scraper - 1" wide or larger
Screwdriver - Blade Type: 1"
6"
9"
12"
Offset

Screwdriver - Phillips:	1" #1, #2
	6" #1, #2
	12" #3
Screwdriver - Pozidriv®	Offset 6", 12"
Screwdriver - Torx Set®	T-15, T-20, T-25, T-30
Socket Set - 1/4" Drive:	3/16" - 5/8" U.S. Standard Depth
	3/16" - 5/8" U.S. Deep
	4mm -14mm U.S. Metric Standard Depth
	4mm -14mm U.S. Metric Deep
	Extensions - Short, Medium, and Long
	Ratchet Handle
	Universal Joint
Socket Set - 3/8" Drive:	1/4" - 7/8" U.S. Standard Depth (12 point)
	1/4" - 7/8" U.S. Deep (6 point)
	8mm - 19mm Metric Standard Depth (6 point)
	8mm - 19mm Metric Deep (6 point)
	Breaker Bar
	Extensions - Short, Medium, and Long
	Ratchet Handle
	Universal Joint
Socket Set - 1/2" Drive:	3/8" - 1 and 1/8" Shallow, Impact or Chrome
	7/16" - 1 and 1/8" Deep, Impact or Chrome
	10mm - 32mm Shallow, Impact or Chrome
	10mm - 32mm Deep, Impact or Chrome
	Breaker Bar
	Extensions - Short, Medium, and Long
	Ratchet Handle
	Universal Joint

Tape Measure (12')
Tire Depth Gauge
Tire Pressure Gauge - Truck
Tool Box
Wire Brush

GENERAL LAB/SHOP EQUIPMENT

The tools and equipment on this list are used in general lab/shop work, but are not generally considered to be individual hand tools. A well equipped, certified program should have all of these general tools and equipment readily available and in sufficient quantity to provide quality instruction.

Adjustable Wrenches - (up to 18")
Air Blow Gun - Rubber Tip (per OSHA requirements)
Air Jacks - (Bottle Style)
Air Ratchet Wrench - 3/8" Drive with Socket Set Standard and Metric

Arc Welder
Axle Stands (minimum 10 ton)
Belt Tension Gauge
Cleaning Tank
Combination Wrench Set - 3/8" - 1 and 1/2" and 6mm - 24mm
3/8" - 3/4" Offset (optional)
7mm - 15mm Offset (optional)
Computer Scan Tool (hand held) - On-Board Diagnostics Level II (OBD) trouble code compliant - (recommended)
Coolant Conditioner Test Kit
Cooling System Pressure Tester
Creepers
Dial Caliper - Standard and Metric
Dial Indicator Set - Magnetic Base
Drain Pan
Drill - 3/8" variable speed, reversible
1/2" variable speed, reversible
Drill Bits - 1/16" - 1/2"
Easy Outs - 1 Set
Feeler Gauge - Blade Type: .005" - .050"
.005mm - .070mm
Filter Wrenches - Small and Large
Fin Comb
Floor Jack - (10 Ton)
Funnels
Gear Oil Dispenser
Grease Gun
Grinder - Bench, 8" Minimum
Hammers - 48 oz. Ball Peen
24 oz. Brass
12 lb. Hand Sledge
Hydraulic Press with Adapters - (50 - 100 Ton)
Impact Wrench - 1/2" Drive with Sockets
3/4" Drive with Sockets
1" Drive with Sockets
Impact Socket - BUDD Wheel
Impact Universal Joints - 3/8", 1/2"
Lifting Chains
Lifting Eyes
Micrometer Set - Standard (0" - 6")
Metric (0mm - 150mm)
Micrometer - Inside (0" - 6")
Depth Micrometer (0" - 6")
Oil Can - Pump Type
Oxy - Acetylene System
Pliers - Snap Ring - internal
external
Wheel Weight
Portable Crane
Porto Power - (minimum of 10 ton)
Pressure Gauge - (0 - 300 psi), (0 - 3000 psi)

Pry Bar Set
Pullers - Two Jaw Set
Three Jaw Set
Pyrometer
Refractometer - (Antifreeze Tester)
Seal Puller
Spring Scale
Socket Set - 3/4" Drive
Allen Drivers: Standard 3/16" - 1/2"
Metric 4mm -12mm
Axle Nut
Crow Feet: Standard and Metric
Torx® Drivers: T-15 thru T-55
Soldering Gun
Tap and Die Set - Standard and Metric
Thermometer
Thread Chaser Set
Tire Chuck - Truck
Tire Valve Core Remover
Torque Multiplier with Adapters
Torque Wrench - 3/8" Drive (0 - 100 lb. ft.)
(0 - 150 lb. in.)
1/2" Drive (0 - 250 lb. ft.)
3/4" Drive (up to 600 lb. ft.)
Transmission Jack
Tubing Cutter/Flaring Set
Vacuum Gauge
Wheel Chocks
Wheel Dolly

SPECIALTY TOOLS AND EQUIPMENT

This section covers the tools and equipment a lab/shop should have for training in any given specialty area. This equipment is specialized and it must be available in the lab/shop. No specific type or brand names are identified because they will vary in each local situation.

Note: All shops are assumed to have an air compressor, air hoses, adequate electrical capability, fender covers, seat covers, and work benches with vises.

SUSPENSION & STEERING

Air Hammer with Chisels
Alignment Equipment: Minimum to perform tasks
Drag Link and Shock Tool
Flow Meter - Power Steering
Pitman Arm Puller
Tape Measure (50')
Tools, those required to check tandem alignment
Wheel Balance, or means by which to determine out-of-balance

BRAKES

Bearing Packer
Bearing Race Installer
Brake Adjusting Gauge
Brake Bleeder
Brake Rotor (Disc) Gauge
Brake Shoe Retaining Spring Tool
Brake Spring Tool (Air, Hydraulic Type)
Disc Caliper Tool for Compressing Caliper Pistons
Drum Brake Gauge
Seal Installers
Seal Ring Installers
Slack Adjuster Index Tool (Template)

* Method for removing asbestos contamination (Parts Cleaner) meeting EPA Standards

HEATING AND AIR CONDITIONING

Air Conditioner Repair Unit - Adapters
Circuit Tester
Dispenser Valves
Leak Detector
Necessary Hoses
Portable Vacuum Pump
Pullers
Ratchet
Removers
Special Feeler Gauges
Thermometer

Charging Adaptor Kit*
Charging Station or Weight Scales & Heat Blanket or Dial-A-Charge
Compressor Oil Dip Stick
Ford Spring Lock Coupler Remover
General Service Truck A/C Manual
Gloves
Halogen Leak Detector (for CFCs and HFCs)*
Heater Hose Clamp-Off Tool
Insulation Tape for Expansion Valves
Manifold Gauge Set*
Measuring Cup
Orifice Tube Remover
Recovery & Recycling Equipment with 2 Storage Cylinders*
Refrigerant Oil
Valve Core Replacement Tool
Various A/C Clutch Pullers

* Meeting EPA Standards
** The Clean Air Act requires separate A/C equipment to service vehicles with Refrigerant HFC-134a.

DRIVE TRAIN

3/4" Drive Pinion Nut Sockets
Aligning Studs - 3/8", 1/2", & 5/8"
Axle Stud Cone Pliers
Blind Hole Puller
Clutch Adjusting Tool (Double Disc)
Clutch Disc Aligning Tool
Protractor (Angle Finder)
U-Joint Puller
Yoke Puller

ELECTRICAL/ELECTRONIC SYSTEMS

Battery Charger (50 AMP Minimum)
Battery Terminal Adapters
Component Jumper Wire Set
Inductive (Clamp-on) Ammeter
Instrument Gauge Tester
Jumper Cable Set
Starting, Charging, Battery Load Tester - (1,000 AMP Minimum)
Terminal Repair Kits
Wiring Diagrams

ENGINE TOOLS

Ball & Hole Gauges
Cam Bearing - Remover/Installer
Dial Bore Gauge
Diesel Compression Gauge
Engine Pre-Oiler
Engine Stands
Fuel Injection Nozzle Pop-Tester
Fuel Site Gauge
Harmonic Balance Puller
Injector Removal Tool(s)
Lift T-Handles
Liner Installer (Universal)
Liner Puller
Manometer - (Water)
Precision Straight Edge
Protrusion Gauge (Cylinder Liner Height)
Radius Gauge Set
Ring Compressor
Ring Expander(s)
Rod Bolt Protectors
Slack Tube or Magnetic Gauge
Soft Jaw Vise
Valve Spring Compressor
Valve Spring Tester

GAS ENGINE TOOLS

Compression Gauge
EFI Pressure Gauge with Adapters
Four Gas Exhaust Analyzer - Bar 90 Certified
Fuel Injector Cleaner
IBM PC Compatible Diagnostic/Information Terminal and/or
Engine Analyzer with Scope
Injector Pulse Tester (Noid Light)
Magnetic Timing Meter or Inductive Pick-up Timing Light
Oxygen Sensor Socket
Spark Plug Boot (Wire) Remover
Spark Plug Socket
Spark Plug Thread Tap

PREVENTIVE MAINTENANCE TOOLS

7-Way Trailer Cord Tester
Stop Watch
Truck Maintenance Inspection Checklist